

UNIVERSITY OF KWAZULU-NATAL

The Graduate Employability of ICT Graduates

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DECLARATION

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ABSTRACT

Skills development is a catalyst that can ensure economic growth in South Africa. However, this development needs to be aligned with industry requirements to ensure that appropriately skilled individuals embark on their careers with confidence and are able to contribute positively to the economy. Information communication technology's (ICT's) ubiquity across all sectors of the economy has spurred demand for skills in this sector. Hence, it is important that graduates possess the necessary knowledge and skills to contribute to the company and economy in the shortest possible time frame. Whilst effort is focused on skills development strategies and policies, there is little evidence to suggest that these efforts produce the desired results of employable graduates. This has raised the question, "Do ICT graduates possess the employability characteristics that are desired by industry?"

The aim of this study was to explore the graduate employability of ICT graduates with specific reference to the software development industry. Furthermore, the study aimed to establish whether the Sector Skills Plan of the Sector Education and Training Authority is aligned with the requirements of the software industry. Due to the expert input required in a study of this nature, a qualitative study was adopted which focused on data collection from experts. These individuals were responsible for their company's graduate programme, which distinguished them as ideal sources of data that could be collected via interviews. Ten companies that employ ICT graduates in their graduate programme were purposefully selected to achieve the study's objectives.

The data collectively led to the conclusion that the graduates do not display the employability characteristics desired by industry. Although they possessed a sound theoretical foundation, they lacked the practical and skills components viewed as fundamental requirements in industry. This was also exaggerated by the graduates' dearth of soft skills. However, the data analysis also highlighted the lack of collaboration between government and industry that further exacerbated the graduates' inability to function effectively in industry. These findings culminated in several recommendations to ensure proper alignment and implementation of skills development and training strategies to produce well rounded graduates possessing the key requirements of industry. Underpinning these recommendations is the need for further collaboration between industry, government and the universities.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASGISA	Accelerated and Shared Growth Initiative of South Africa
CIPC	Company and Intellectual Property Commission
DHET	Department of Higher Education and Training
DOE	Department of Education
DOL	Department of Labour
DUT	Durban University of Technology
EJB	Enterprise Java Beans
FET	Further Education and Training
GDP	Gross Domestic Product
GEAR	Growth, Employment and Redistribution
HTML	Hyper Text Markup Language
ICT	Information Communication Technology
ILO	International Labour Organisation
JIPSA	Joint Initiative on Priority Skills Acquisition
JSP	Java Server Pages
KZN	KwaZulu-Natal
MICT	Media Information Communication Technology
MIS	Management Information System
NQF	National Qualifications Framework
NSDS	National Skills Development Strategy
RDP	Reconstruction and Development Programme
SAQA	South African Qualifications Authority
SARB	South African Reserve Bank
SETA	Sector Education and Training
SQL	Structured query language
SSP	Sector Skills Plan
StatsSA	Statistics South Africa
THRIP	Technology and Human Resources for Industry Programme

CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

The drive towards automation intensified as industries exhausted other avenues of gaining efficiencies. This led to massive uptake and widespread integration of computer software- and hardware-based solutions. Business-to-business integration has raised the bar in the race to gain competitive advantage. Suppliers can replenish stocks before shelves run empty without an order being placed by “the buyer”. This was the basis of Sam Walton’s pioneering efforts at Walmart which saw him invest in information system development to address these needs. The shelves will never run dry as suppliers are well aware of stock levels at all stores. The investment has seen Walmart gain significant competitive advantage in the retail sector. However, all this was only possible through the development of robust software solutions that matched the needs of industry. The growing need for these solutions created a new vacuum in the labour market, that of the knowledge worker and more specifically the information communication technology (ICT) professional.

Moore’s law had defined ICT hardware evolution since 1965 while shifting paradigms in software development, such as procedural to object-oriented development has coerced ICT professionals into constant upskill mode. This, combined with the ever-changing needs of industry necessitated a similar shift in skills development strategies and plans. This would ensure an abundant supply of home bred skills that should prevent large scale global outsourcing while also ensuring economic growth. Bożykowski, Izdebski, Jasiński, Konieczna-Sałamatin, Styczeń and Zając (2014) stated that the outcomes of changes in education systems are only understood when the learning process is complete and the graduates are employed. This is significant in the South African context as the changes in post-apartheid skills development processes could only be measured when those within the system were exposed to industry.

The mark of effective skills development strategies would lie in the readiness of the graduates for industry. Hence this study focused on the readiness of ICT graduates for the software development industry in order to identify whether the skills and knowledge of graduates were in line with industry requirements.

This chapter provides an overview and motivation for the study, a brief discussion of the problem, the chosen research methodology and data collection method, as well as the limitations of this study.

1.2 MOTIVATION FOR THE STUDY

Numerous theoretical frameworks exist on graduate employability, some of which are briefly reviewed in this study. However, information and research into graduate employability in the ICT sector, and in particular the software development industry in South Africa has been found to be scarce in the past five years.

Schofield (2014) stated that the Media, Information and Communication Technologies (MICT) Sector Education and Training Authority (SETA) Sector Skills Plan (SSP) is based on its levy payers and excludes industry sectors that belong to other SETAs but manage their own ICT operations. Therefore, the MICT SETA SSP cannot be viewed as an accurate assessment of future needs of the ICT sector. A better understanding of the knowledge and skill requirements of the software development industry as well as that of graduates would assist in identifying the gaps that exist in graduates' knowledge and skills. These could then be addressed by the Department of Higher Education and Training (DHET) through curricula and other interventions to ensure alignment of industry needs with education and training initiatives.

Selected software development companies that provide intensive graduate programmes were chosen for this study so that the research could provide a relevant picture of the current situation. This can benefit companies, as well as the students, education institutions and the DHET. The DHET can benefit by gaining an understanding of what shortcomings exist, if any, while students will gain the benefit of being instructed in the most relevant topics required by industry. Educational institutions can benefit as their curricula can be made relevant to the present times thus enhancing their reputation, while making it easier to gain national and international accreditation. Companies will benefit because graduates will be in a position to be productive and contribute to their employees in a much shorter time frame.

1.3 PROBLEM STATEMENT

The skills possessed within a country represent the factors of production which determine the production decisions of an economy. South Africa is no different from the rest of the world in this regard. However, a major shift in the local economy from one that was based on commodities and mining towards one based on manufacturing and trade necessitated an appropriate shift in skills development policies and strategies. These changes were also necessary in order to address unemployment appropriately. The benefits of this would be increased GDP resulting in increased spending and economic growth. A key test of whether the skills development policies and strategies are effective would be to test graduate employability. Graduates that possess appropriate skill sets can be productive and contribute to their companies and the economy much faster, thus fast tracking economic growth.

The literature reviewed for this study indicated a lack of studies to determine the graduate employability of ICT graduates. It is argued that the pervasive nature of ICT across all sectors of the economy makes it deserving of further investigation to ensure that training and development strategies are aligned with the requirements of industry. However, a study encompassing all sectors in the ICT industry would be too broad and hence a focused approach concentrating on the software development sector was undertaken for this research study.

The question that this study aimed to answer is “Are ICT graduates appropriately skilled for the software development sector of the ICT industry?”

1.4 AIMS AND OBJECTIVES

The aim of the study was to explore the graduate employability of ICT graduates with specific reference to the software development industry.

The following were the objectives of this study:

1. To establish the type of job roles employed within software development companies.
2. To identify the technical knowledge and skills required by the ICT software development sector.
3. To identify the soft skills desired within the ICT software development sector.
4. To establish the gaps in ICT graduates' knowledge.

5. To investigate what employers are doing to get their ICT graduates to be job ready.
6. To establish what amendments need to be made to university/college curricula.

This research generally explored the knowledge and skills that ICT graduates have brought into the ICT's software development sector while also determining the knowledge and skill requirements of the sector. The disparity between these formed the basis for determining whether the graduates were ready for industry. This research also determined whether industry is seen as a stakeholder in determining the graduate curriculum.

1.5 POPULATION AND SAMPLE

This study focused on companies that run a graduate recruitment programme which includes the ICT software development functions of the company. A purposive sample of ten companies was chosen based on judgement sampling. This was due to the individuals possessing the information, facts and experience that were required to provide the responses. Samples were, however, selected in a proportionate representative manner as based on the MICT SETA's highest number of ICT employers per province. The companies that participated in the study and their respective national presence, based on the three most highly rated provinces, are illustrated in Table 1.1.

Table 1.1: Participating companies and their locations

Company	Gauteng	KwaZulu Natal	Western Cape
Company A		✓	✓
Company B	✓		
Company C		✓	
Company D		✓	
Company E		✓	
Company F	✓		
Company G			✓
Company H	✓		✓
Company I	✓		
Company J	✓		
Company K	✓		
Total	6	4	3

It is evident from Table 1.1 that 54% of the companies are based in Gauteng, with 36% in KwaZulu Natal and 27% in the Western Cape. This is considered a reasonable reflection of the ICT employers and ICT enterprises within South Africa (MICT, 2013; Schofield, 2014).

It is relevant to state that the graduate programme of one of the companies was run separately by different individuals in the various provinces. These provincial branches of the company operated independently in this regard. Therefore, these branches were treated as separate and individual companies in this respect, making the total number of participant companies eleven.

1.6 DATA COLLECTION METHODS AND TREATMENT OF DATA

A loosely structured interview schedule (Appendix 3) was utilised to guide the data collection process. This afforded flexibility during data collection as the interviewer was able to probe with follow-up questions in order to gain insight and clarity of the participants' thoughts and ideas.

The identification of categories and themes during the data analysis process provided a foundation from which the results were structured. Rather than predefine themes, the data was analysed for relevant themes within the paradigms of the objectives and questions asked. This ensured that category reliability of the data was maintained.

The researcher selected to provide visual presentation of the results. This was achieved through the use of tables, word clouds and graphs. These were then interpreted and conclusions were drawn from them. Direct quotations from participants were also used to provide clarity and evidence to support the findings of the data reduction and analysis process.

1.7 LIMITATIONS OF THE STUDY

The results of an exploratory study cannot be generalised to the population (Sekaran & Bougie, 2013, p. 97). Furthermore, purposive sampling resulted in only three of the nine provinces of South Africa being represented. However, the prime purpose of the study was to gather and analyse expert opinions from those actively involved in the graduate programme of their companies that develop software. Data reliability is ensured as the

gathering and analysis of data can be reproduced. However, the interpretation of the data may be different. Further limitations are discussed in Chapter Five of this dissertation.

1.8 OUTLINE OF THE STUDY

The research study process was conducted in a structured and systematic manner.

Table 1.2 illustrates the format of the study which is presented and documented in five chapters.

Table 1.2: Structure of this study

Chapter	Description
One	This chapter provides an overview of the study. The research process is introduced, with the motivation for the study and problem statement followed by the presentation of the aims and objectives. The population and sample are then described followed by the data collection method and limitations of the study.
Two	Chapter Two presents a literature review of the main concepts and factors surrounding graduate employability. The funnel concept employed is initiated with an analysis of the South African economy followed by a discussion on unemployment and skills development. This filters through to a discussion on graduate employability, culminating in a discussion of the factors affecting employability in the ICT sector.
Three	Chapter Three provides an overview of the research methodology, design and approach adopted for this study.
Four	This chapter presents the analyses of the data collected. It provides a description of the participants, followed by the presentation and analysis of the data structured by the objectives of the study.
Five	This is the concluding chapter of the study. It provides a summary of the study highlighting conclusions and recommendations drawn from the findings. This is concluded by recommendations for future study.

1.9 SUMMARY

Skills development strategies and plans must to be aligned with the requirements of industry in order to maintain its effectiveness. Hence any changes in industry dynamics need to be reflected in these strategies in order to maintain relevance. This is more pertinent for the ICT sector due to the constant improvements in its toolsets and rapid technological changes such as the boom of mobile software development. This study has aimed at determining the graduate employability of ICT graduates for the software development sector. This chapter provided a motivation for the study leading up to the problem statement and aim and objectives. This was followed by an introduction to the population and sample, and the limitations and outline of the study. The next chapter adopts the funnel approach to a literature review by discussing the theoretical basis for this study, and commences with a discussion on the local economy, leading to graduate employability.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 INTRODUCTION

South Africa's high unemployment rate is well documented with the dearth of skills highlighted as one of the contributing factors. However, it seems paradoxical that unemployment can be accompanied by skills shortages. A logical plan to tackle the unemployment problem would be to focus training and development efforts in areas that experience skills shortages. Although the skills shortage in the ICT sector attracts a fair amount of contention, the sector's evolving nature ensures that skill requirements are never stagnant. Higher Education and Training Institutions are tasked with the responsibility of imparting these skills through strategies devised by government. However, uncertainty abounds on the extent of new graduates' employability. This chapter provides an overview of the economy, unemployment, skills development and graduate employability, with a view towards understanding the graduate employability of ICT graduates specifically in the software development field.

2.2 OVERVIEW OF THE SOUTH AFRICAN ECONOMY

Edigheji (2010) summarised the South African economy since the advent of democracy in 1994 as being characterised by reductions in government debt due to reduced fiscal deficit; attracting moderate economic growth; overall lower inflation and interest rates than pre-democracy (the global economic collapse in 2008 and 2009 aside); and a free-floating exchange rate resulting in high volatility. Furthermore, high income inequality resulted in a higher than desired Gini coefficient. The Gini coefficient is an instrument that provides a means to measure income distribution inequality, a higher value indicates greater inequality (Ryu, 2013). Unemployment remained steadily high with minor improvements noted in 2006 and 2007.

Schiller (2011) stated that scarcity is the central problem faced by many countries and is the key factor in resolving production decisions that must be made. This is further dependent on the factors of production, namely land, labour, capital and entrepreneurship. Labour, being one of the key factors, becomes a constraining factor of these production decisions when there is a shortage of skilled labour. Macroeconomic policy, the labour

market and unemployment provide key insight into production decisions and vital input into education and skills development policies of an economy.

2.2.1 Macroeconomic policy

The ultimate objective of macroeconomic policy frameworks are a combination of high economic growth and low unemployment contained in a low inflationary environment (Omay and Öznur Kan, 2010; Phiri, 2014). The South African Reserve Bank's (SARB's) monetary policy includes an inflation targeting framework that has been employed since 2000 (SARB, 2014).

2.2.1.1 Inflation targeting

The detrimental effects of high inflation, albeit at a critical threshold, on output growth rate is well documented (Vinayagathan, 2013; Baglan & Yoldas, 2014). An understanding of this relationship is critical for sound policy making (Seleteng et al., 2013). Inflation targeting is one of the frameworks within which policies are made and has been adopted by a growing number of countries (Castillo, 2014). The four elements of inflation targeting are:

- ▶ directing monetary policy towards achieving price stability;
- ▶ ensuring controls are in place to hold the central bank accountable for achieving monetary policy goals;
- ▶ making public the inflation targets; and
- ▶ having a strategy to ensure that the rationale for a central bank's decisions is communicated (Eichengreen, 2002).

In 1990 New Zealand was the first country to introduce inflation targeting to address high inflation and improve output (Petreski, 2014). During the next five years the framework was adopted by other economies including Canada, Australia, Sweden, Finland and Spain. The adoption resulted in them achieving an average annual inflation rate below 2% at the time (Mallik & Bhar, 2011). This provided the backdrop for sufficient empirical evidence of the effectiveness of inflation targeting to control and reduce long run inflation and thus output volatility (Batini, Kuttner & Laxton, D, 2005; Mishkin, 2007; Freedman & Laxton, 2009).

Mollick, Cabral and Carneiro (2011) and Amira, Mouldi and Feridun (2013) provided further evidence of the positive contribution of inflation targeting to growth in other

economies, and they stated that it provided higher output growth in emerging economies. The fact that inflation targeting can reduce variability in output and real interest rates provides the stable environment needed for growth in South Africa (Kahn and de Jager, 2011). This growth is the catalyst that sparks demand for both skilled and unskilled labour. Another macroeconomic framework employed is the “Accelerated and Shared Growth Initiative of South Africa” (ASGISA) (Phiri, 2014).

2.2.1.2 Accelerated and Shared Growth Initiative of South Africa (ASGISA)

The South African Government has implemented many programmes aimed at addressing the social challenges faced after democracy. These included the Reconstruction and Development Programme (RDP) implemented in 1994, the Growth, Employment and Redistribution (GEAR) programme implemented in 1996, and more recently the Accelerated and Shared Growth Initiative of South Africa (ASGISA) which was introduced to the nation by President Thabo Mbeki in his State of the Nation Address (Chagunda, 2006). Although ASGISA had its detractors (Steyn, 2006; Preece, 2006), government nonetheless forged ahead with the initiative. ASGISA’s objectives are to stimulate increased economic growth through various interventions identified by government and it strives to be participative so that its benefits are shared by all in the country (The Presidency, 2008). Mubangizi (2008) argued that “neoliberal measures” such as ASGISA have proved ineffective in alleviating poverty. However, the negative effects of the global financial crisis in 2007 and 2008 should not be discounted when evaluating ASGISA’s success.

In the build up to ASGISA, skilled labour shortage, amongst others, was recognised as a “binding constraint” to economic growth (Mlambo-Ngcuka, 2006). Interventions to address these constraints include addressing “macroeconomic issues, infrastructure programmes, sector investment strategies, skills and education initiatives, secondary economy interventions and public administration issues” (Mlambo-Ngcuka, 2006). Some of the projects borne from these interventions were biofuel initiatives, sugar projects in KwaZulu-Natal, the proposed Square Kilometre Array and various other infrastructure projects (The Presidency, n.d.). The main aims of ASGISA were to halve unemployment and poverty by 2014, accelerate employment equity and enhance broad-based black economic empowerment (McGrath & Akoojee, 2007). Although minor success was noted for employment equity and broad-based black economic empowerment, ASGISA’s

unemployment targets were considered ambitious and were severely missed. The South African Government's realisation that GDP growth, and hence employment, was being constrained by a skills shortage led to the establishment of the Joint Initiative on Priority Skills Acquisition (JIPSA) (Behar, 2006; Moorosi, 2009). Furthermore, JIPSA was seen as a part of ASGISA that deals with the manner in which people will be equipped with the skills needed for them to participate in the growth of the economy. Skills shortages in priority areas were identified and JIPSA aimed to address these through long-term strategies that included educational programmes and bringing back retirees for mentorships (Moorosi, 2009). ASGISA's identification of skilled labour shortage can only be understood through a discussion of the labour market, which is dealt with in the following section.

2.2.2 The labour market

The formal industry sectors in South Africa consist of agriculture, mining, manufacturing, utilities, construction, trade, transport, finance, community and social services and private households (Statistics South Africa, 2014). Table 2.1 shows the distribution of the workforce employed per sector.

Table 2.1: Employment by industry sector

Sector	Employment percentage
Community and social services	23
Trade	21
Finance	13
Manufacturing	11,5
Construction	8,5
Private households	8
Transport	6
Agriculture	5
Mining	3
Utilities	1

Source: Adapted from Statistics South Africa. 2014. Quarterly Labour Force Survey: Quarter 3: 2014 [Online]. Available: <http://beta2.statssa.gov.za/publications/P0211/P02113rdQuarter2014.pdf> [Accessed 25/01/2015]

It is evident that community and social services provide the largest number of jobs followed by trade and then finance. This picture provides a clear indication of the nature of the labour market and is also a determinant of the skills required for it. Conspicuous by its absence is the ICT sector.

2.2.2.1 The ICT labour market

ICT's natural generic characteristics include collection, storage, processing and distribution of information. This has attracted a general-purpose technology classification that has confirmed its pervasiveness across all sectors of the economy (Røpke, 2012). The prevalence of ICT was evidenced by the change in the end user's nature of work which shifted skills requirements to include basic computer skills during the late 1990s (Ryan & Watson, 2003). ICT's prevalence was further intensified through the ease of which the internet became accessible, resulting in the sector drawing interest from other unrelated sectors such as media (Fransman, 2010). The ramifications of this pervasive nature were that ICT permeated society to such an extent that it has become an integral part of business and individuals' lives (Gebhardt, Greif, Raycheva, Lobet-Maris & Lasen, 2010; Kretschmer, 2012). Kretschmer (2012) further concluded that there was overwhelming evidence of the increasing productivity gains offered by ICT in industry. This enhanced the attractiveness of ICT adoption, increasing its reach across the various sectors. In as much as ICT does not enjoy the status of having a sector of its own within South African statistics, the evidence shows that there is a broad market for ICT skills in South Africa. Should this be ignored, solutions would lie in large scale international outsourcing which would rob the country of highly needed employment opportunities and growth.

The brief synopsis of the South African economy evaluates government's interventions to stimulate growth. This is necessary to alleviate unemployment which is a key goal of governments around the world. Although unemployment would normally find its place within the economy, its importance in the context of this study necessitates a discussion of its own.

2.3 UNEMPLOYMENT

Amongst various measures of unemployment, two of the most common adoptions are categorised into the broad and narrow measures of unemployment. The difference between the two lies in the jobless person's attempts to search for work within a specified time period (Kingdon & Knight, 2006).

2.3.1 Definition

Statistics South Africa (StatsSA), the country's key labour force data provider, has adopted the International Labour Organisation's (ILO's) definition of the unemployment rate as it is also adopted by many of their major trading partners (Statistics South Africa, 1998). The ILO definition is based on one adopted by the Thirteenth International Conference of Labour Statisticians at Geneva in 1982 and further resolved at the 2013 convention. Unemployed individuals are those persons who are above a certain age and have fulfilled the following during the period of reference:

- ▶ They were without work, i.e. not in paid or self-employment.
- ▶ They have made themselves available for work either via paid or self-employment.
- ▶ They have actively attempted to obtain either paid or self-employment within a specified recent period (International Labour Organization, 2013b).

Accordingly, the strict definition of unemployment describes unemployed individuals as those individuals who actively seek but are unable to find employment (South African Reserve Bank, 2014). This is also in line with the narrow definition of unemployment. Before outlining South Africa's unemployment statistics and youth unemployment, a brief explanation of the effect of the gross domestic product (GDP) on unemployment is needed.

2.3.2 Effect of GDP on unemployment

Okun's Law, broadly stated, argues that a negative correlation exists between unemployment and GDP, where positive increases (in GDP) are usually accompanied by a drop in unemployment (Okun, 1963; Burgen et al., 2012; Ball et al., 2015). This was confirmed by Bhorat, Goga and Stanwix (2013) in their findings of a positive correlation between employment and GDP growth trends in South Africa between 2001 and 2012, with employment increases being lower nonetheless. It is further argued that during periods of economic contraction the employment rate shrinkage was more prominent than GDP shrinkage, as evidenced during the 2008/2009 recession. This sheds further light on

the reasons why the strategies of the South African Government to combat unemployment include GDP growth.

2.3.3 Unemployment statistics

The unemployment situation in South Africa as provided by Statistics South Africa is summarised below. The overall unemployment rate is followed by a breakdown at the provincial level and then by age group.

2.3.3.1 The unemployment rate

The ratio of unemployed individuals to the labour force is given as the unemployment rate which is currently 25,4% in South Africa (Statistics South Africa, 2014). However, the unemployment rate does not constitute a holistic view of the labour market as the duration of unemployment must also be considered. This is due to individuals who are unemployed for extended periods of time running the risk of becoming unemployable due to skills erosion (ILO, 2013a). Furthermore, it is likely that this is the result of structural issues that need to be addressed in the labour market.

2.3.3.2 Provincial level

Figure 2.1 shows the employment status of the population grouped by province.

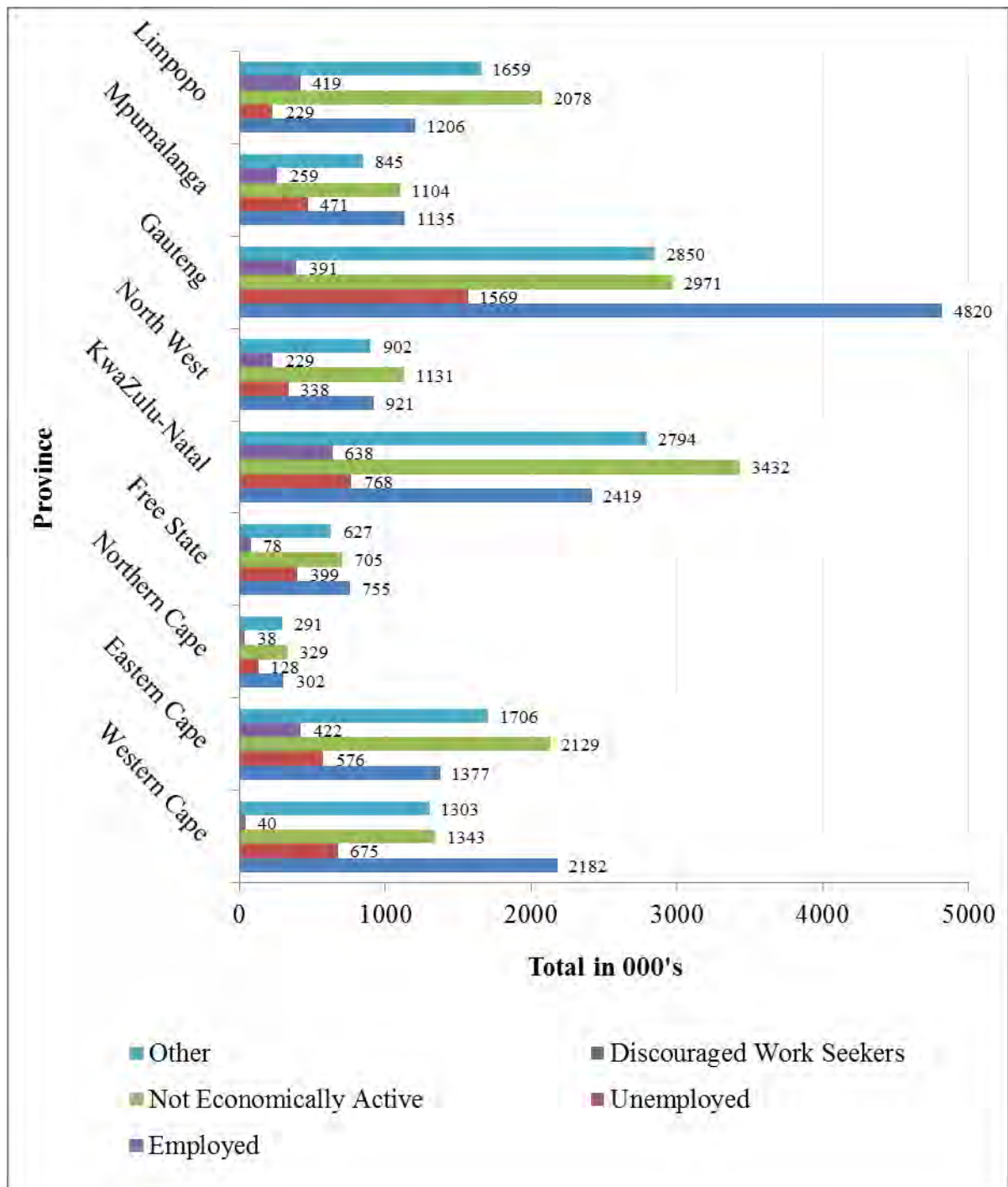


Figure 2.1: Employment in South Africa by provinces

Source: Adapted from Statistics South Africa. 2014. Quarterly Labour Force Survey: Quarter 3: 2014 [Online]. Available: <http://beta2.statssa.gov.za/publications/P0211/P02113rdQuarter2014.pdf> [Accessed 25/01/2015].

Gauteng, being the economic hub of South Africa, has the highest employment and unemployment figures. KwaZulu-Natal tops the discouraged work seeker and not economically active categories.

2.3.3.3 Age group

Figure 2.2 shows the employment status of the population by age group.

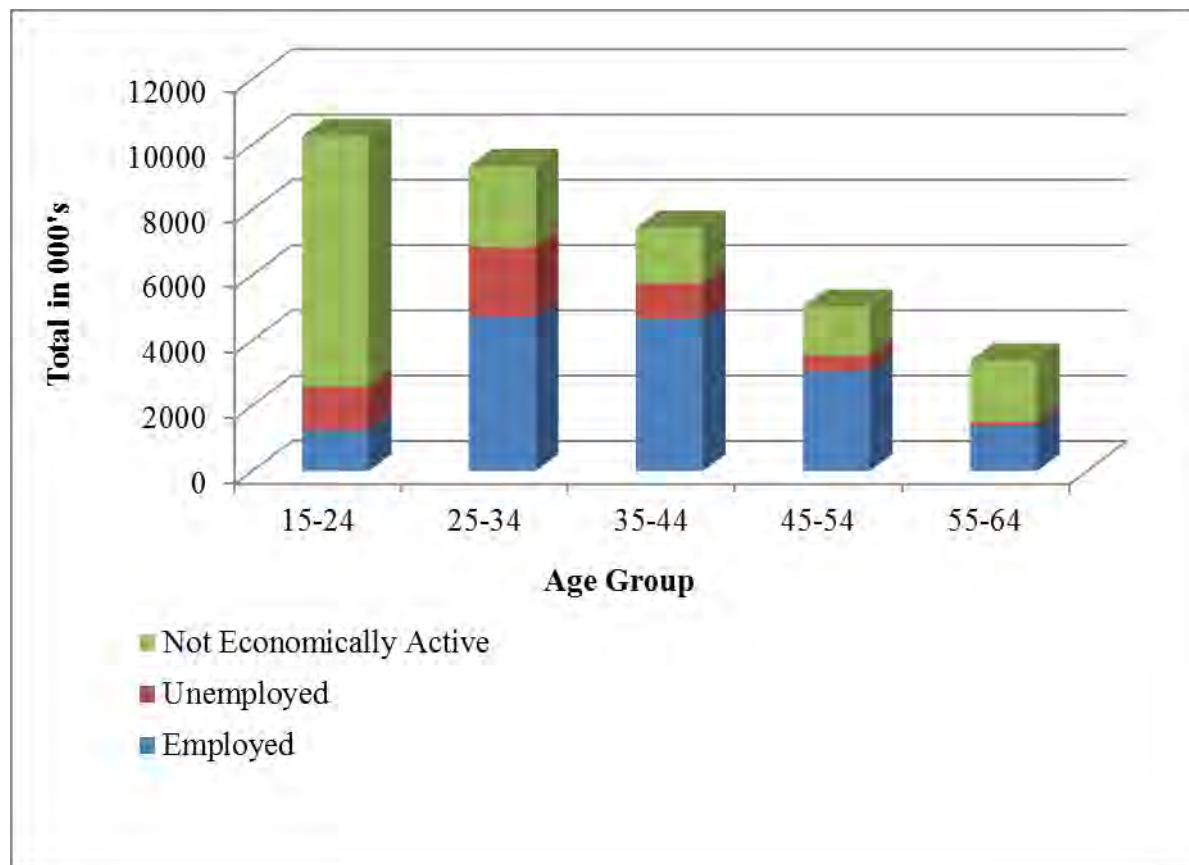


Figure 2.2: Employment status by age group

Source: Adapted from Statistics South Africa. 2014. Quarterly Labour Force Survey: Quarter 3: 2014 [Online]. Available: <http://beta2.statssa.gov.za/publications/P0211/P02113rdQuarter2014.pdf> [Accessed 25/01/2015]

It is observed that the age groups of 15-24 and the 25-34 years had the highest unemployment rates. However the 25-34 years age group also had the highest employment rate.

As most graduates are young individuals, Figures 2.1 and 2.2 paint a very bleak picture of their employment prospects, especially in Kwazulu-Natal. A discussion on youth unemployment is thus appropriate.

2.3.4 Youth unemployment

Although various definitions of youth exist (O'Higgins, 1997), the International Labour Organization (2011) (ILO) adopts one that defines youth as those individuals aged from 15 to 24 years of age. The ILO (2011) confirmed that a youth jobs crisis exists, with the youth in developed economies bearing the brunt of the crisis when compared to their counterparts in developing countries.

Parodi, Pastore, Tanveer Choudhry, Marelli and Signorelli (2012) stated that a key contributing factor to this crisis is the low human capital and skills possessed by young people. Mauro and Carmeci (2003) identified that the human capital required for employment was education and generic and job-specific work experience, the latter of which can only be acquired through working activities. The transition from school to work is another deteriorating factor in which contributes to youth unemployment (Marginean, 2014). Støren (2011) argued that this is mitigated to an extent in countries that have an intermediate link, such as apprenticeships, between school and work. However, the study only considered school leavers and not graduates or tertiary institute leavers.

Breen (2005) concluded that labour legislation favouring employees, with particular regard to dismissals, and a lack of positive signals from tertiary institutes about the ability and skills of their graduates play significant roles in the high unemployment rate of youth. Van Aardt (2009) justified South African employers' stance and stated that the bias of the Labour Relations Act towards employees in matters of dismissals forces companies to be risk averse when employing youth. Rankin and Roberts (2011) also found that high wage expectations and the reluctance to work in small companies exacerbate youth unemployment in South Africa.

Rampant unemployment and skills shortage seem an odd mix. However, unemployment will persist if the unemployed population is not trained and developed in the skills that are required by industry. Hence, appropriate skills development plans and policies play a major role in alleviating unemployment.

2.4 SKILLS DEVELOPMENT

Education is one of the cornerstones that fuel a country's economic growth (Ball, 2013; Shrivastava & Shrivastava, 2014). Robbins, Judge, Odendaal and Roodt (2009, p.456) concurred by stating that the single most significant drawback to South Africa's

development in both the public and private sector is the shortage of skills. Akoojee (2012) also stated that “skills development is critical to South Africa’s development”. The Department of Higher Education and Training (DHET) (2013b) recognised that information about the skills needed by society and the economy is key to ensure better forecasting and planning of education and training. Moreover, these findings would inform how companies and government undertake human resource planning, funding programmes, development of education programmes, and to an extent, government’s immigration strategies. An understanding of the skills definition is required before analysing it in the South African context.

2.4.1 Definition of skills

Robbins et al. (2009) defined skill as “an ability to do something well due to training, development and experience”. Van de Werfhorst (2011) stated that skill and knowledge have education as their base. These combined factors influence worker productivity as well. Lim, Anderson and Mcgrath (2012) maintained that although the concept of skills was first applied in vocational education/training, the notion has spread to all aspects of education, including tertiary education. Furthermore, the view that even non-technical skills such as communication, teamwork and even emotional intelligence could be delivered from teachers to students as training blocks, has led to extensive uptake of the “skill toolkit” as almost any desirable skill becomes trainable. Lauder, Young, Daniels, Balarin and Lowe (2012) discussed skills within the context of two paradigms that aim to bridge the divide from education to the labour market. The first of these acknowledges the difference in academic and job knowledge with the supposition that the former promotes generic skills required for work. The second is based on competence which is defined as the combination of technical and soft skills required to perform a job. Brown, Lauder and Ashton (2011) provided a different perspective, stating that being highly skilled is not an implicit result of being highly qualified. This conflicts with the view of Lauder et al. (2012) that academia is the base. Allais (2014, p.180) argued that “skills are not objective phenomena that can be measured and accounted for, which individuals either do or do not have”.

The evolution of the skills definition, highlighted above, entails a shift towards ensuring that relevant skills, that may not necessarily be academic in nature, must be acquired by students in all educational institutions in order to increase their chances of successfully

contributing to the economy. This can only be achieved through the implementation of a three pronged approach incorporating government, universities and industry.

2.4.2 The triple helix

Etzkowitz and Leydesdorff (1995) argued that an overlapping of boundaries between universities and industries had developed with both sectors taking responsibility for tasks that clearly fell within the other's domain. Furthermore, due to government's involvement being implicit, the "triple helix" phrase that describes the alliance between government, universities and industry was coined. The term is based on the premise that universities merely supply skills to industry. This resulted in skills development being seen as an end rather than a means to promote innovation and economic growth. One of the ways in which the triple helix approach manifests itself in South Africa is through the Technology and Human Resources for Industry Programme (THRIP). Doret and Johan (2014) have provided empirical evidence of the benefits it has brought to industry and universities. Of the many benefits, the most relevant ones to this research are that the universities are kept in touch with the market and employment opportunities open to students working on these projects.

2.4.3 The South African context

McGrath (2004) argued that the apartheid regime's skills development policies were festured with inequality in public education and an artisan training programme reserved only for white men. Bird and Heitmann (2009) noted further that this regime did its utmost to ensure that the Black majority were left predominantly unskilled to ensure a sufficient supply of cheap labour. Schoole (2013, p.2) concurred, adding that the apartheid education system was "renowned for its racial inequalities" and that reform was necessary. The reform needed to be addressed at the core of skills development which is the legislative framework.

2.4.3.1 The legislative framework

The legislative framework defines the parameters within which skills development is pursued in South Africa. Figure 2.3 illustrates a timeline of the relevant legislation coupled with the role of the SETAs.

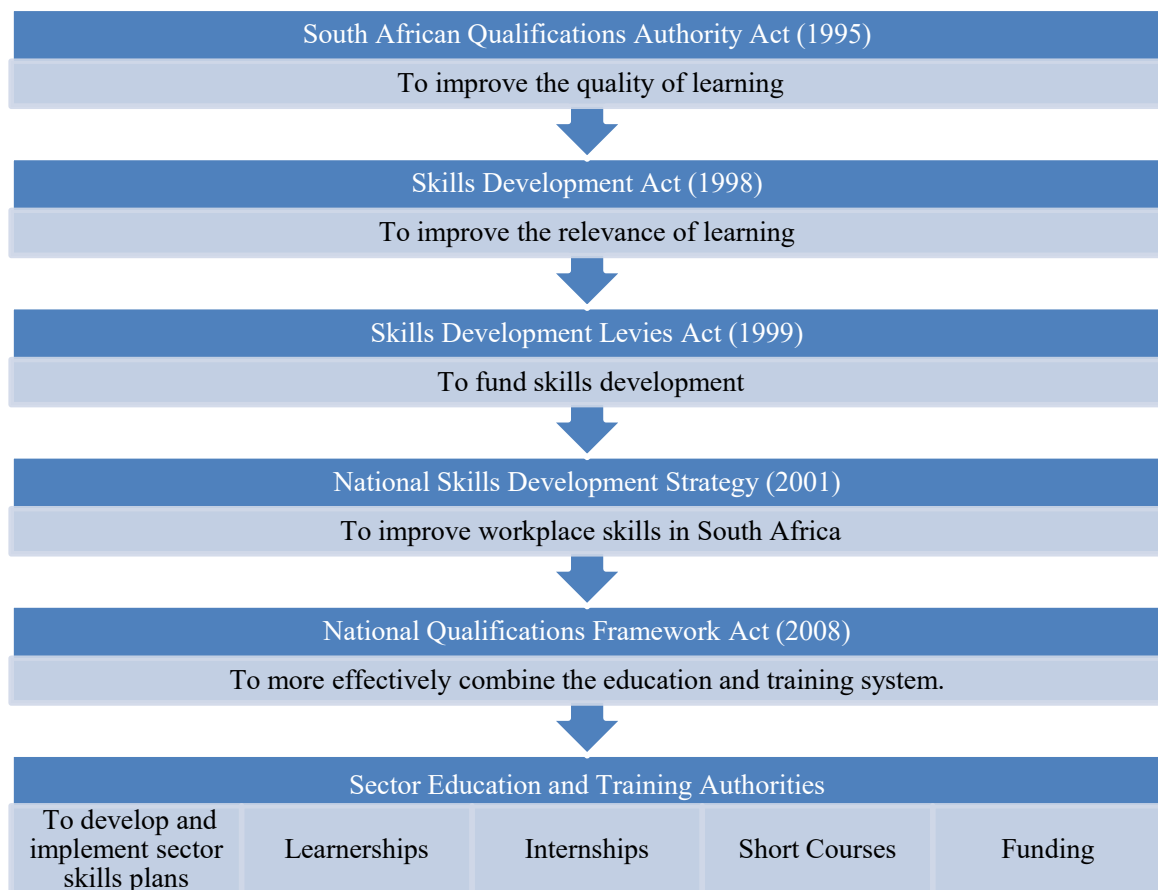


Figure 2.3: Skills development legislation

Source: Adapted from Janse Van Rensburg, C. 2010. Organisational perspectives of learnerships within manufacturing, engineering and related services organisations in the Sedibeng municipal district area [Online]. Vaal University of Technology. Available: <http://196.21.64.68/handle/10352/91> [Accessed 23/02 2015].

Figure 2.3 indicates that skills development legislation began with the SAQA Act in 1995 followed by the Skills Development Act (1998). In order to provide a mechanism for funding skills development the Skills Development Levies Act (1999) followed. These culminated in the National Skills Development Strategy and the National Qualifications Framework Act. The formation of Sector Education and Training Authorities resulted from the Skills Development Act (1998). The SETA's core focus is on the Sector Skills Plan that encompasses all forms of skills development including learnerships, internships, short courses and funding, and hence its position at the bottom.

The South African Qualifications Authority Act 58 of 1995 was the start of reform from apartheid with the establishment of the South African Qualifications Authority (SAQA) and the formation of the South African National Qualifications Framework (NQF) (Keevy,

2013, p.21). The NQF's regulatory and transformational aims were to ensure that the system "encouraged life-long learning" even though Allais (2011) argued that there was little evidence to support the numerous claims that NQFs were achieving their goals. The National Commission on Higher Education was also appointed in 1995. Its mandate was to make recommendations on higher education transformation through a process of research and consultation in the sector. This culminated in the promulgation of the Higher Education Act 101 of 1997 (Schoole, 2013). The Council on Higher Education was thus established.

The South African Qualifications Authority Act was replaced by the National Qualifications Framework Act 67 of 2008. This Act retained its original objectives but aimed to combine the different components of the education and training system more effectively (Keevy, 2013). Furthermore, SAQA and the Quality Councils were now made jointly responsible for creating and maintaining an internationally comparable, transparent framework for learning recognition. The sole purpose of the Further Education and Training Act 98 of 1998 was to legally transform the (newly termed) "public further education and training colleges" into multiracial institutes (McGrath, 2010). Thus, a number of former Black and White institutions were merged to form 50 Further Education and Training (FET) colleges.

The Department of Education's (DOE) core responsibility was on "supply-side institutional entities" while The Department of Labour (DOL) was responsible for skills development (Akoojee, 2012). Tasking these two departments with mapping the education and skills strategy of the country was bound to cause confusion and conflict (McGrath and Badroodien, 2006; Bird and Heitmann, 2009). Akoojee and McGrath (2008, p.199) intimated that improved synergy between the two departments was required to break the discontinuities that existed between education and training. Although Lugg (2009) argued that the NQF was developed as an attempt to bridge this divide, Allais (2011) found that there was no improvement in communication between labour markets and education and training systems after the implementation of the NQF. Furthermore, Allais (2011) found that qualification frameworks did not improve the mismatch of skills requirements between labour supply and demand. These issues were brought to the fore by the introduction of JIPSA, the necessity for which seemed controversial due to the existence of the National Skills Development Strategy (Bird and Heitmann, 2009). The consequence was that a separate ministry, the department of higher education and training (DHET), was created to

address the country's education, training and skills development needs while also addressing the disjointedness created by the abovementioned departments (Akoojee, 2012). The DHET absorbed relevant institutional entities into its fold from the DOE and DOL. Figure 2.4 shows the structure and the various branches of the DHET.

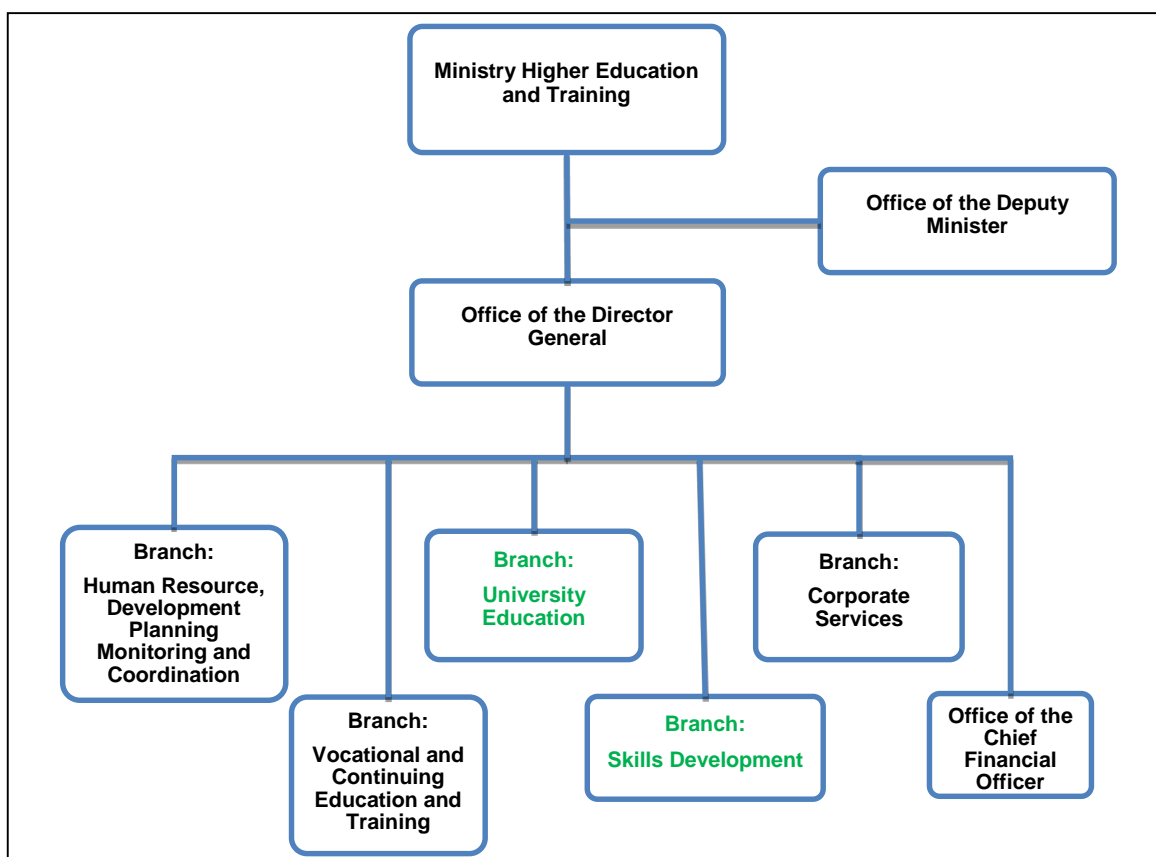


Figure 2.4: DHET organisational structure

Source: Adapted from Department Of Higher Education And Training. 2015. Organisational Structure [Online]. Available: http://www.dhet.gov.za/SitePages/Org_OrganisationStructure.aspx [Accessed 07/02/2015].

The figure provides a view of the branches that are now under the DHET. It is noticeable that the various branches have been amalgamated from the DOE and the DOL. The main 'branches' of concern for this study are university education and skills development. University education regulates the higher education system and ensures effective strategies are in place for higher education development. The main purpose of the skills development branch is to promote and monitor the National Skills Development Strategy.

2.4.3.2 The National Skills Development Strategy

The National Skills Development Strategy (NSDS) was introduced in 1997 and aimed to address the skills development challenges within post-apartheid South Africa. This strategy was broken down into three phases, namely the NSDS I, NSDS II and NSDS III. Although the NSDS I and NSDS II did not achieve their expected results, they provided important building blocks for NSDS III (DHET, n.d.). NSDS III aims to address the challenges faced by education and training stakeholders in order to encourage economic expansion and employment (Department of Higher Education and Training, 2013a). Outcome 4.2.3 of the NSDS III to ensure that “high level national scarce skills needs are being addressed by work ready graduates from higher education institutions” is of particular relevance to this study. Such outcomes were to be achieved via mechanisms such as the sector skills plans developed by the relevant SETAs. The ICT industry falls within the ambit of the Media Information Communication Technology (MICT) SETA.

2.4.3.3 MICT SETA

The MICT SETA is a Schedule 3A public entity established in terms of the Skills Development Act (Act 97 of 1998). Its mandate is to implement its sector skills plan which aims to identify scarce skills within the industry and implement appropriate interventions to address the shortcomings (MICT SETA, 2014). Figure 2.5 shows the forecasted scarce skills in the information technology subsector for the period 2013 to 2018.

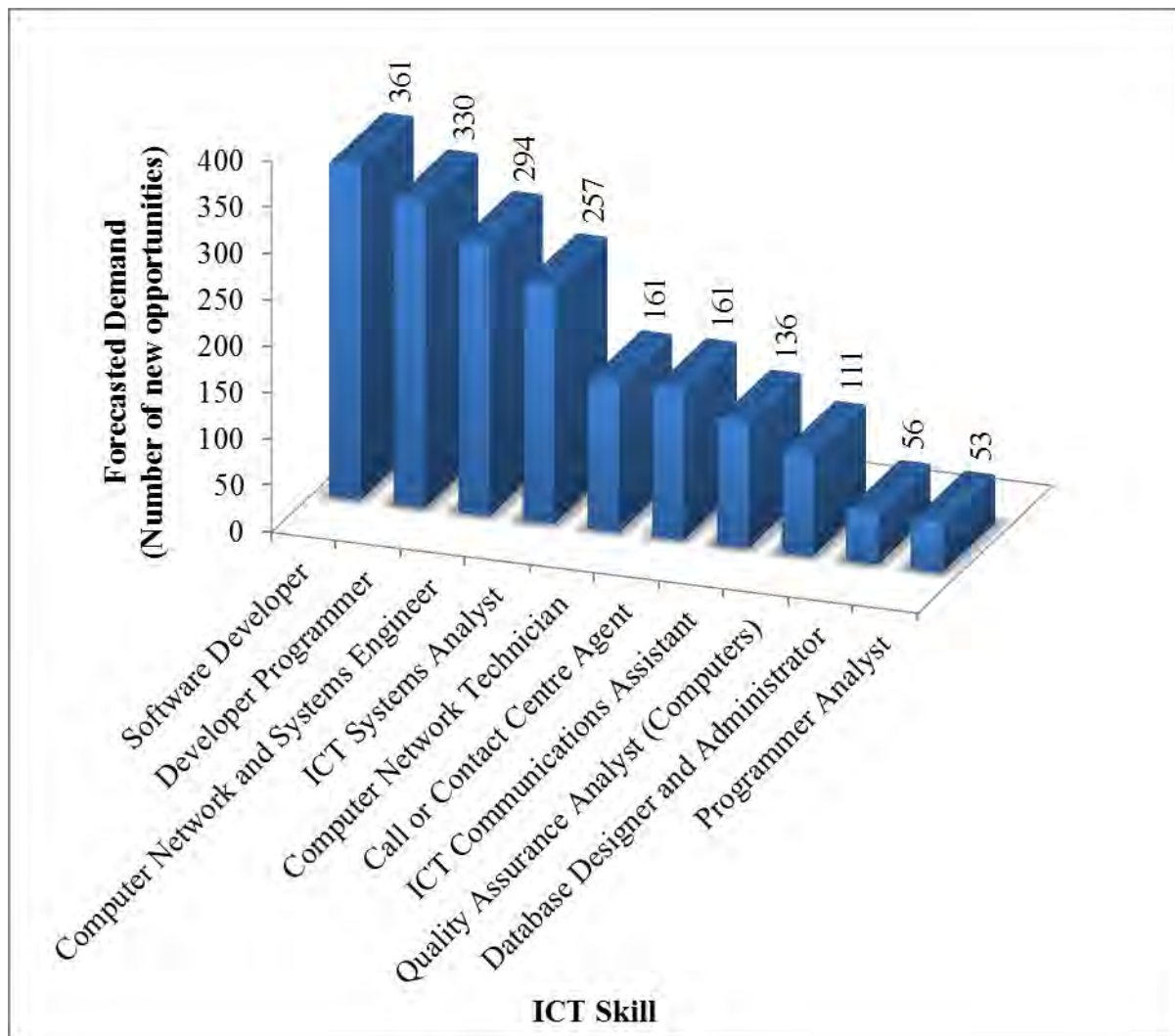


Figure 2.5: Scarce skills forecast in the information technology sector

Source: Media Information Communication Technology Sector Education Training Authority. 2012. The Media, Information and Communication Technologies Sector Education and Training Authority Sector Skills Plan 2013–2018 [Online]. Available: http://www.mict.org.za/downloads/MICT_SSP_2013_2018_November_2012_V1_1.pdf [Accessed 24/02/2015].

Figure 2.5 indicates that the skill that is likely to be in highest demand is software development closely followed by developer programming. It is further noted that the top four skills in demand will be at job levels that require formal tertiary qualifications such as a diploma or degree from a Higher Education Training Institute.

The range of frameworks and technologies available to the software development and programming sectors are vast (Bischofberger and Pomberger, 2012). Combining this with the need for soft skills puts the sector in a very precarious situation as there will be a dearth

of suitably qualified individuals, should the focus be on a generic understanding of the concepts that can be easily applied to any framework or should the actual technology in high demand be used. A solution would be to use the technology in high demand to deliver the generic concepts. To this end the MICT SETA has compiled a list of skills that are in demand, as illustrated in Table 2.2.

Table 2.2: MICT SETA's sector skills demand

Development products and technologies	Programming products and technologies	Soft and other skills
Togaf	C++	Managerial
SAP	Linux	Negotiation
Advanced Business Application Programming (ABAP)	ASP.Net	Presentation
	C#	Asset Management
Microsoft Lync Server	Progress	Conflict Resolution
Oracle	SharePoint	Executive Coaching
E-Commerce	Java 2 Enterprise Edition	
Customer Relationship Management	Spring	
	Weblogic	
SharePoint	Customer Relationship Management	
Evo 1, 2, 3 & 4	Delphi	
Advanced ABAP	Structured Query Language	
Advanced Business Intelligence Supply Chain Management	Advanced Java	
	Java Script	
	CGS	
Advanced WebDynpro	Image manipulation	
Silverlight	Hyper Text Mark-up Language	
	RNO	
	Red Hat	

Source: Adapted from Media Information Communication Technology Sector Education Training Authority. 2012. The Media, Information and Communication Technologies Sector Education and Training Authority Sector Skills Plan 2013–2018 [Online]. Available: http://www.mict.org.za/downloads/MICT_SSP_2013_2018_November_2012_V1_1.pdf [Accessed 24/02/2015].

The development products and technologies indicate a strong bias towards commercial products such as SAP, Oracle and Microsoft. A point to note in the programming products and technologies section is the demand for technologies that have a common base framework. C++, C# and Delphi are all object oriented programming languages that share the same concepts. An understanding of these concepts combined with the syntactic structural know-how would allow an individual to easily migrate between these languages. The soft and other skills point to a lack of skills for supervisory and managerial roles.

The MICT SETA's Sector Skills Plan (SSP) is a forecast of skills that are in demand in the immediate future as it is based on levy paying members' skills development plans. Furthermore, it does not consider industries that fall outside its mandate but may have an ICT division. Hence, it is also necessary to determine what skills will be in demand in the short and long term and what the views from the entire industry are in this regard.

2.4.3.4 Skills shortage in the South African ICT sector

From the definition of skills provided by Robbins et al. (2009), it would follow that a skills shortage would be a scarcity of people who have been trained and developed while possessing the necessary experience to do something well. Ivanovic and Collin (2003 cited in Janse van Rensburg, 2010) defined skills shortage as “a lack of employees with certain skills”. This is usually due to demand outstripping supply for the skill.

Roodt and Paterson (2009) highlighted the contradicting claims of a skills shortage in the South African ICT sector with privately funded research not disclosing the exact methodology used and thus casting doubt on the results. To this end, a proper methodology is described and the shortage of appropriately skilled individuals in the computer professionals' category is confirmed. The Department of Higher Education and Training (2014) also commissioned its own study and identified the top 100 skills across all industry sectors that were in demand. Software developers were amongst the ICT-related job categories on the list. However, Lotriet, Matthee and Alexander (2011) provided further

evidence of flaws in the findings by Roodt and Paterson. Their analysis unveiled failings in several research reports on ICT skills shortage in South Africa. Some of the challenges they identified were “the worrying absence of various critical research elements, the extent of data gathered, the political structure of the ICT landscape, skills classification difficulties and higher education MIS data” (Lotriet et al., 2011). They do however concede that complications in the ICT sector skills gap is compounded by the accelerated evolution of technology within the industry ultimately making the skills shortage difficult to address. This also resulted in the curriculum and teachings of universities diverging with industry needs.

Schofield (2014) defined and applied a robust methodology when he indicated that application development occupied a top five spot as a priority area in the South African ICT sector. Other areas included cloud computing, network infrastructure, information security and business intelligence. He concluded that the programming languages that would be in high demand through 2015 would be Java, C# and .NET. He also called for more cooperation between the various Sector Education and Training Authorities with regard to ICT roles, thereby reinforcing the idea of ICT being pervasive across all sectors of the economy. Dwolatzky (2014, cited in Schofield, 2014) stated that a pipeline consisting of internships, amongst other factors, can play a key role in alleviating youth unemployment in Africa.

2.4.4 Internships

Renganathan, Zainal Ambri Bin Abdul and Chong Su (2012) described internships as programmes through which students are able to combine knowledge gained in the classroom with the real world of work. Sweitzer and King (2013, p.3) described internships as a “critical component in academic programs” consisting of a thorough field experience. Internships provide opportunities for both personal and professional development via concrete experience, reflective observation, abstract conceptualisation and active experimentation. Furthermore, these internships are aimed at college and university graduates. Knouse and Fontenot (2008) confirmed that there are benefits attached to internships with employability also increasing. Binder, Baguley, Crook and Miller (2015) concurred, and stated that all students can acquire some benefit from internships. Furthermore, they advised that universities should pay extra attention to internships due to the added employability agenda created by the various international university ranking systems. Narayanan, Olk and Fukami (2010), however, were more circumspect about how

benefits of internships are brought about even though they do concede that internships can have positive influences on many career indicators, but this has to be under the right circumstances. The general consensus was that internships can play a key role in getting graduates to be job ready.

2.5 GRADUATE EMPLOYABILITY

Education's basic purpose is to ensure that labour market needs are met (Cai, 2013). However, education alone does not suffice as there has been an increased demand for employable graduates (Tomlinson, 2007). Furthermore, the global shift towards knowledge-driven economies necessitated a focus on knowledge workers possessing the relevant work-related skills and capabilities to match (Hassard et al., 2008; Watson and Reissner, 2010). Governments therefore recognise higher education's role in determining the quality of human capital (Yorke and Knight, 2007). Prokou (2008) thus noted that higher education is tasked with the responsibility of advancing graduate employability. These factors have enhanced the importance of the graduate employability paradigm.

2.5.1 Definition of graduate employability

As graduate employability follows on from the employability concept, a definition of employability is first provided here.

2.5.1.1 Employability

Hillage and Pollard (1998) defined employability "simply" as "being capable of getting and keeping fulfilling work". Furthermore, this is broken down into a three step process of gaining initial employment, maintaining this employment and obtaining new employment. Brown et al. (2003) criticised this definition as "ideologically loaded" and "a classic example of blaming the victim". They cited the example of 30 individuals applying for 10 vacancies with the inevitability that 20 individuals will be unsuccessful. There is no evidence to support the notion that the 20 individuals were not employed due to their lack of good employability characteristics. To this end he contended that the labour market and not individuals determine employability and put forth that employability is "the relative chances of acquiring and maintaining different kinds of employment". Gazier (2001) proposed an evolution of the employability concept through seven operational versions over the past century. These include dichotomic, socio-medico, manpower policy, flow, labour market performance, initiative and interactive employability. His latest version,

interactive employability, introduced in the 1990s is based on an individual's employability relative to others and the labour market. Sanders and de Grip (2004) concurred with Hillage and Pollard while maintaining that the individual also needs to be proactive and react to changes in the work environment and the manner in which they perform their functions. Hence, an individual's employability is not static and can change over time. This is consistent with the discussion on the ICT Labour Market where the adoption of ICT necessitated upskilling so that individuals would remain employable.

2.5.1.2 Graduate employability

Knight and Yorke (2004) and Poropat (2011) defined graduate employability as being centred on a set of attributes and skills that increases the likelihood of an individual to find employment. Yorke (2004) added that these attributes are also likely to enhance graduates' success in their chosen careers to the benefit of all. Dacre Pool and Sewell (2007) also argued that although graduate employability can be defined as whether or not a graduate secures a job, a more precise definition would incorporate whether or not the job is at a graduate level. Hence, a key factor for graduate employability must be based on whether the "skills, knowledge and understanding" attained during studies are applied in the course of that employment. Further references to employability include immediate and sustainable employability. Immediate employability refers to the graduates' "ability to cope with the rigours of the workplace without any further training", while sustainable employability refers to the ability to remain employable after the first graduate job is found (Watts and Team, 2006). Mason, Williams and Cranmer (2009) added to the immediate employability concept by incorporating that the new graduates' "skills, knowledge, attitudes and commercial understanding" enable them to be immediately productive towards the objectives of the organisation. These definitions are not meant to be exhaustive but sufficiently capture the essence of graduate employability.

A common characteristic noted throughout the evolution of the employability concept is that it centred on individual attributes (Yorke and Harvey, 2005; Clarke, 2008; Hogan et al., 2013). This notion was not exclusive and extended to graduate employability as well. The employability framework provides more insight into the concept.

2.5.2 Employability framework

The conceptual foundation of employability is based on the supply and demand side paradigms (McQuaid and Lindsay, 2005). The supply side concerns the individual's skills

and attracts significant government intervention to solve employability issues (Hillage and Pollard, 1998; Sanders and de Grip, 2004; Tomlinson, 2012). This concept is based on the premise that there is no constraint on demand from employers but resultant unemployment is due to the individual's lack of motivation and willingness to work (Hartshorn and Sear, 2005). However, employability based on individual skills (supply side) alone, apportions total liability to the individual for not being employed, without considering the demand from the labour market which may provide limited job opportunities. To this end, contextual factors such as employer behaviour and labour market conditions must also be considered (McQuaid and Lindsay, 2005). Although these factors may constitute a holistic view of the employability framework, the supply and demand side factors are not exclusive and quite often a combination of these were considered. A further factor that bears mention within the South African context is affirmative action. When selection is based on demographic characteristics that are legislatively accommodated for, the role of graduate employability is diminished.

Various models of employability have been developed to understand and measure it. The key factor in this study is that employability is viewed from the perspective of the individual's capability, and hence an overview of some of these models is discussed.

2.5.3 Employability models

Cranmer (2006) noted that defining employability was trivialised in comparison to measuring it. Several models of employability relate to the individual perspective. These include models by Fugate, Kinicki and Ashforth (2004), McQuaid and Lindsay (2005), Fugate and Kinicki (2008) and Finch, Hamilton, Baldwin and Zehner (2013).

Fugate et al. (2004) proposed that employability is a psycho-social construct that consists of personal adaptability, career identity and social and human capital dimensions. Personal adaptability refers to the individual's ability and willingness to adapt and change their personal factors such as knowledge, skills and behaviour to meet demands in the work environment. Career identity refers to the way in which individuals see themselves in their roles at work. This also helps with direction as it addresses the "who I am or want to be" in the work environment. Human capital refers to factors such as age, experience skills and knowledge while social capital includes factors such as the relationship support structures the individual is able to maintain so that they are able to call upon the right person in a

particular situation. This model was found to be suitable in the unemployment context (McCardle, Waters, Briscoe, & Hall, 2007).

McQuaid and Lindsay (2005) proposed an employability framework that consisted of individual factors, personal circumstances and external factors. However, they noted that employers' circumstances also determine the priority of these factors when employing. For instance, an employer may be more flexible in employing an individual that does not possess all the necessary formal academic qualifications during periods of skills shortage. Although this employability framework is exhaustive, it may be necessary to filter out some of the factors due to their discriminatory nature. Typically, differentiating on the basis of certain demographic characteristics such as age may defy legislation as is the case in South Africa where any form of discrimination is forbidden in terms of the Constitution of the Republic of South Africa, 1996 and the Labour Relations Act (Act 66 of 1995).

Fugate and Kinicki (2008) provided a dispositional model to employability. Its dimensions include openness to changes at work, work and career resilience, work and career proactivity, career motivation and work identity. This model takes the view that an individual has a "perpetual readiness for change" and is able to identify opportunities and exploit them.

Finch et al. (2013) identified 17 factors influencing graduates' employability and concluded that these can be sectioned and grouped into higher order categories. These categories are problem-solving skills, pre-graduate experience, soft-skills, job-specific functional skills and academic reputation.

There are many other models of employability (Van Dam, 2004; Heijde and Van Der Heijden, 2006; Dacre Pool and Sewell, 2007; Coetzee, 2008) but a comprehensive analysis of these models falls outside the scope of this study which is intended to be viewed from a business and not a psychological perspective.

2.5.4 Factors affecting employability in the ICT sector

Pruijt (2013) stated that maintaining employability in the ICT field provides numerous challenges. Companies are simultaneously hiring and firing while software developers remain unemployed even in the face of unfilled vacancies. Marks and Scholarios (2008) argued that companies are placing less emphasis on technical qualifications as these could be trained, implying that they did not feature highly as an employability attribute in the

software sector. However, Marks and Huzzard (2010) found that small businesses placed enormous emphasis on qualifications and technical skills thus impacting on these as employability attributes. Pop and Barkhuizen (2010) found that, in the South African context, graduate internships made large contributions to enhancing soft skills. Thus the emphasis of employability was not only limited to technical skills.

2.5.5 The role of higher education institutes

Enhancing student employability has become one of the primary goals of higher education institutes (Poropat, 2011). Job readiness has led to them including employability skills as part of the graduate curriculum (Durrani and Tariq, 2012). However, these requirements change over time and also differ for the various markets and career streams, making it difficult for the institutions to identify and timeously implement what employers want. This is also dependent on the extent of collaboration between industry and higher education institutes. Poropat (2011) also argued that disparities exist whereby skills development is the emphasis of graduate programmes while performance in the workplace is valued by employees.

2.6 SUMMARY

This chapter introduced the state of the South African economy, culminating in a discussion on the high unemployment position that it finds itself in. The concept of skills development necessitated from the will to address unemployment and ensure economic growth was then presented. The alignment of skills development initiatives with the needs of industry cannot be over emphasised, as this ensures the development of relevant skills that would in turn encourage economic growth. This cyclical effect is inevitable. Hence, the discussion on the legislative framework and the role of Sector Education and Training Authorities in skills development followed. However, the identification of skills that will be demanded in future is an imprecise art and the methodologies used to determine the same were at best questionable. Hence, the concept of graduate employability was introduced culminating in a discussion on some of the models employed to measure this concept.

This literature review has exposed the lack of evidence to correlate the job readiness of graduates for the ICT sector from a technical and soft skills perspective as determined by the Sector Skills Plan of the MICT SETA. A two-fold problem therefore needs further

investigation. Firstly, it is necessary to understand the graduate employability of ICT graduates and secondly to verify whether the Sector Skills Plan is in fact aligned with the needs of the software development industry.

The next chapter outlines the methodology that was used to conduct the empirical study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

There is extensive academic research on graduate employability frameworks and their application in various sectors. However, the review of relevant literature in the previous chapter has identified the need for further research on the graduate employability of ICT graduates with specific focus on the software development sector. Research into this field has been found to be minimal over the past five years.

This chapter outlines the research methodology adopted for the study. The aims and objectives of the study are presented as a preamble to the research methods appropriate for a study of this nature. This culminates in a discussion on the data collection strategies and data analysis techniques employed.

3.2 UNDERSTANDING OF RESEARCH

Guthrie (2010, p 3) stated that “research is concerned with collecting and analysing data systematically to help solve problems that concern us”. Research is often commonly associated with reading books and internet searches. However, these only form a part of the research activities. Sekaran and Bougie (2013) concurred by defining research simply as the drawing of conclusions from a systematic analysis of the factors affecting a problem. These conclusions are meant to provide solutions to problems and allow for more appropriate decision making. Business research is viewed as a management risk mitigation tool due to the reduced uncertainty achieved from its use (Coldwell & Herbst, 2004).

3.2.1 Research methodology

Coldwell and Herbst (2004) stated that research methodology in business research provided management with necessary tools to extract information that is used by the key decision makers of the business. Kothari (2011) defined research methodology as “a way to solve a research problem”. Furthermore, methodologies differ from study to study and it is the researcher’s responsibility to ensure that the correct and most appropriate methodology is adopted. There is also a distinct difference between research methodology and research methods with the latter defining the techniques used to conduct research. The

information that is collected via the methodology and methods can only be reliable if a scientific approach is adopted.

Business researchers adopt a scientific method towards research that is similar to testing a hypothesis (Hair, Celsi, Money, Samouel & Page, 2003). Kothari (2011) stated that the scientific method is a common philosophy in all research methods and techniques and is the logical process and considerations in pursuit of the truth. Figure 3.1 is a flow chart of the actions and steps required for effective research to be carried out.

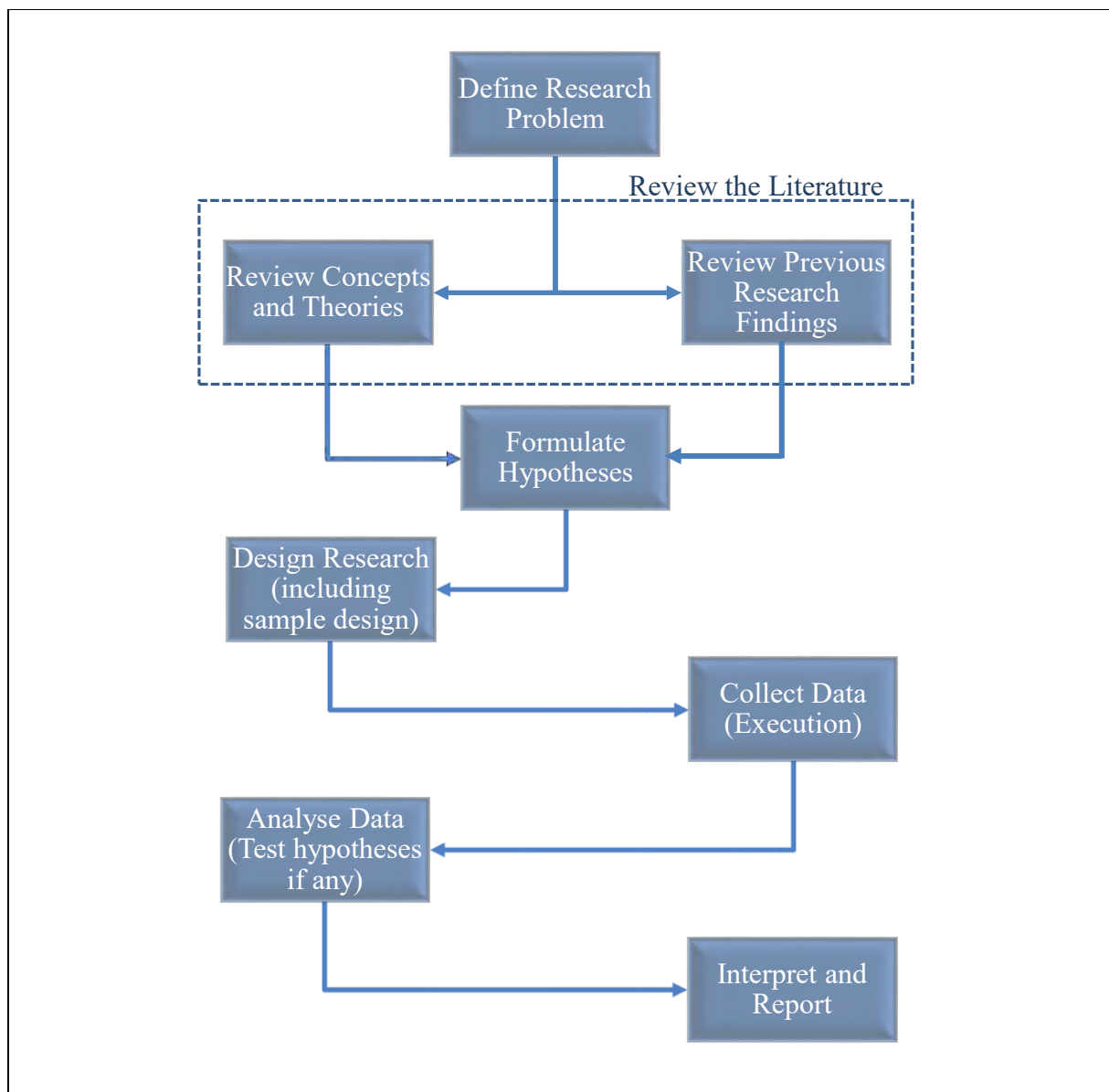


Figure 3.1: Flow chart of the research process

Source: Kothari, C. R. 2011. Research methodology: methods and techniques, New Age International.

It is evident from Figure 3.1 that the research process starts with the research problem followed by the literature review, formulating the hypothesis, designing the research, collecting and analysing the data and finally interpreting and reporting on the findings. Formulation of the aim and objectives are done at step 3.

3.3 AIM AND OBJECTIVES OF THE STUDY

The hypothesis formulation step in the research methodology includes the definition of the aim and objectives of the study.

3.3.1 Aim

The increasing benefits afforded to industry by the use of ICT have caused its rampant adoption across various sectors of the economy. This has necessitated an appropriate shift in training and skills development strategies to accommodate this growth. However, the inherent evolving nature of the ICT industry requires constant refinement of these strategies, as training and industry requirements easily diverge if these strategies are not constantly monitored and adjusted accordingly.

The aim of the study was to explore the graduate readiness of ICT graduates with specific reference to the software development industry.

3.3.2 Objectives

The objectives of the study are listed below:

- ▶ To establish the type of job roles employed within software development companies.
- ▶ To identify the technical knowledge and skills required by the ICT software development sector.
- ▶ To identify the soft skills desired within the ICT software development sector.
- ▶ To establish the gaps in ICT graduates' knowledge.
- ▶ To investigate what employers are doing to get their ICT graduates to be job ready.
- ▶ To establish what amendments need to be made to university/college curricula.

3.4 RESEARCH DESIGN

The research design is a decision-making process that aims to identify and answer the what, where, when, how much, and by what means questions of a study (Kothari, 2011). Furthermore, it is the conceptual structure that determines the manner in which data will be collected, measured and analysed, and thus ensuring that the research is conducted as efficiently as possible. Determining the participants and location of the study provides a good starting point to the research design.

3.5 PARTICIPANTS AND LOCATION OF THE STUDY

The unit of analysis refers to the manner in which the data collected is grouped together for analysis (Sekaran & Bougie, 2013). Furthermore, the unit of analysis facilitates the aggregation of data and is determined by the research question. Although this study aimed to determine the graduate employability of a group (ICT graduates), data was collected and analysed from the individuals who were interviewed and hence the unit of analysis was the individual.

The companies chosen for this study had to employ ICT graduates. Furthermore, these companies either specialise in software development or carry out in-house software development to support the core functions of the business. The participants in this study were the individuals who played a major role in the recruitment and development of the ICT graduates within their respective companies. The roles of these individuals have been identified as either the human resources managers or the graduates' mentors.

The location of the study was determined by identifying the provinces with the highest number of ICT employers. The bulk of ICT employers within South Africa are based in Gauteng (40%), Western Cape (8%) and Kwa-Zulu Natal (8%) (MICT, 2013). According to Schofield (2014), a split of 45% in Gauteng, 23% in Western Cape and 10% in KwaZulu Natal can be considered a "reasonable reflection of the ICT enterprises in South Africa". Hence these provinces were chosen as the locations for the study.

3.6 TYPE OF STUDY

Saunders, Lewis and Thornhill (2009) described the three types of research as exploratory, descriptive and explanatory. Sekaran and Bougie (2013) concurred, albeit naming

explanatory as hypothesis testing. Exploratory studies are undertaken to unearth more information about a situation when little or no data is available on the subject, while descriptive studies attempt to describe characteristics of the elements in the study (Sekaran & Bougie, 2013). Furthermore, hypothesis testing, also known as causal studies, aim to determine the extent to which relationships between variables exist, basically establishing whether an event is or is not caused by another (Hair et al., 2003). This study was exploratory as it attempted to provide an understanding of whether ICT graduates are job ready and if the skills they gain during their studies are relevant to industry. The type of study is a key input into determining the approach that must be used.

3.7 APPROACH

The two basic approaches to research are quantitative and qualitative (Kothari, 2011). Quantitative approaches to research involve the generation of numerical data that is rigorously analysed in a formal and rigid framework. Conversely, a qualitative approach involves the collection of non-numeric data. It is based on the “subjective assessment of attitudes, opinions and behaviour” (Kothari, 2011).

Sekaran and Bougie (2013) stated that the determinant of adopting a qualitative or quantitative approach depends on whether the study is descriptive or exploratory in nature. This study was exploratory, as described in Section 3.6 above, with information sourced from specialists in the field and hence a qualitative approach was adopted to determine if ICT graduates possess the relevant skills required by industry.

3.8 SAMPLING

A sample is defined as a subset of a larger group of elements to be studied (Sekaran & Bougie, 2013). Sampling is the process of selecting this subset. An understanding of the population of the study is required before sampling is carried out.

3.8.1 Description of the population

The population refers to all the elements (people or things) of interest in the particular universe of the study (Sekaran & Bougie, 2013). This study’s population incorporated all companies that employ ICT graduates and carry out software development activities either as their core business or as a supporting function to the business. As this is a qualitative study, the number of companies that carry out this function is immaterial due to the

purposive nature of sampling used. This is explained further in Section 3.8.3 (Sampling design and sampling method). Nevertheless, it is usually impractical to study the entire universe and therefore a sample is used (Guthrie, 2010).

3.8.2 The need to sample

Guthrie (2010) stated that the main reasons for sampling are that it is both efficient and effective. Furthermore, provided the sample is carefully chosen, generalising the outcome from the sample to the population is possible. Saunders et al. (2009) justified sampling for the following reasons:

- ▶ Impracticality of surveying the entire population.
- ▶ Budget constraints.
- ▶ Time constraints.
- ▶ Turnaround times.

Due to the sheer size of the population it may be impractical to survey the entire population. Furthermore, permission to collect data may not be granted by some organisations. Although it may be possible to survey the entire population at times, budget and time constraints may make this impossible. Design of questionnaires and interviews and administering the same would also increase costs and time required. Turnaround times are also usually quicker when using sampling, as the time taken to enter and analyse the data from a sample rather than the entire population will be quicker.

Qualitative and quantitative research differs in the approaches to sampling (Patton, 2002). This is seen as one of the core differences between the two.

3.8.3 Sampling design and sampling method

Sampling is broadly categorised into probability and non-probability sampling (Saunders et al., 2009).

Figure 3.2 illustrates the most frequently used sampling techniques.

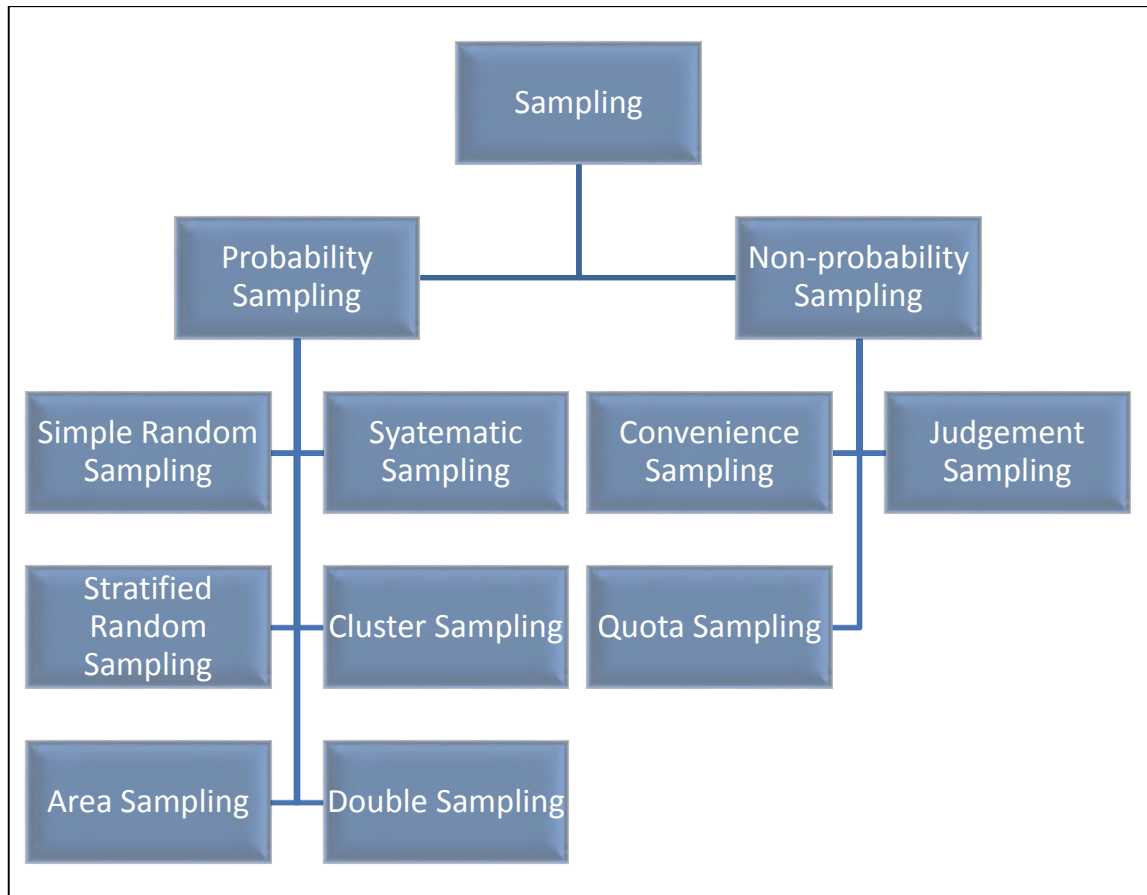


Figure 3.2: Frequently used sampling techniques

Source: Sekaran, U. & Bougie, R. 2013. Research methods for business: a skill-building approach, Chichester, West Sussex, Wiley.

Probability and non-probability sampling is further categorised into appropriate subcategories as indicated in Figure 3.2. The difference between the two sampling categories lies in the fact that the probability of a case being selected from the population in probability sampling is known and usually equal for all cases in the population. This is not the case for non-probability sampling which makes it inappropriate for use in research that requires statistical inferences on the entire population. Patton (2002) stated that qualitative inquiry is typified by the depth and breadth of information gathered, due to the open-ended nature of data collection. Hence, samples are small, even single cases in some instances, and selected purposefully. Therefore non-probability sampling, also known as purposeful sampling, was selected for this study.

Figure 3.2 illustrates that non-probability sampling consists of convenience, quota and judgement sampling. In convenience sampling, subjects are chosen based on the ease with

which they are accessible while subjects in quota sampling are chosen according to some predetermined quota in order to ensure appropriate representation of groups. Drawbacks to these designs are that they are not easily generalisable to the population (Sekaran & Bougie, 2013). Subjects in judgment sampling are chosen according to their expertise and knowledge in the field being investigated. Although generalisability to the entire population is questionable, judgment sampling is more reliable than the two former designs. It also presents a quick and inexpensive way to obtain preliminary information (Sekaran & Bougie, 2013). Identifying an appropriate sampling frame assists in selecting the sample for the study.

3.8.4 Sampling frame and size

The sampling frame is a comprehensive list of the elements in the study from which the sample is drawn or identified as the case may be. Situations in qualitative studies exist where it may be difficult to determine the sampling frame since the characteristics of the elements involved in the study may not be accurately documented (White, 2002). As such, a best effort approach was taken as follows. The database of the Company and Intellectual Property Commission (CIPC) was used to search for ICT companies that operate in the regions specified in Section 3.5 above. This was further filtered by selecting only those companies that develop software and employ ICT graduates. A judgement sample of ten companies was selected from this list since the information required for this study could only be provided by specific individuals who possess the experience and knowledge in the field to provide the facts (Sekaran & Bougie, 2013). The judgment criteria used for selecting these companies was based on their active participation in career expos and fairs held by the various higher education institutions.

3.9 DATA COLLECTION STRATEGY

Research strategies include experiments, surveys, observation, case studies, grounded theory, action research and mixed methods (Sekaran & Bougie, 2013). The nature of this study lends itself to adopting a survey strategy and the data collected is primary data. Kothari (2011) stated that primary data collection is best achieved through observation or direct communication with respondents (surveys). These strategies include but are not limited to observation methods, interview methods, questionnaires and through schedules. Hair et al. (2003) suggested focus groups, in-depth interviews, Delphi techniques or

projective techniques for exploratory studies. As this was an exploratory qualitative study, interviews were the tool of choice for data collection.

3.9.1 Interviews

Interviews provide a good platform to generate qualitative data through question and answer sessions in a conversational form (Guthrie, 2010). Furthermore, although it is time consuming, its flexibility and the ability to gain immediate clarity and in-depth understanding of ideas and concepts via follow-up questions make it especially useful for data collection. The three main types of interviews are unstructured, structured, and semi-structured interviews. Unstructured interviews, also known as informal interviews, take the form of a general conversation (Guthrie, 2010). Sekaran and Bougie (2013) stated that unstructured interviews are geared towards obtaining preliminary information to unearth underlying issues that may need further investigation. There is also no planned sequence of questions, and impromptu follow-up questions are allowed. Structured interviews are made up of a list of predetermined questions that must be comprehensive and include probe and follow-up questions (Guthrie, 2010). As the questions are predetermined, a structured interviewing technique does not lend itself to gaining in-depth information. Hence it is used when the information to be obtained is known at the outset (Sekaran & Bougie, 2013). Semi-structured interviews, also known as guided interviews, are a combination of both structured and unstructured. An interview guide or schedule is used so that different interviews for the study are comparable (Guthrie, 2010). The interviewer is allowed some flexibility to omit certain questions or probe for more information should the need arise (Saunders et al., 2009). Interviews can also be individually administered or conducted in groups. These are commonly known as personal interviews and focus groups respectively (Saunders et al., 2009).

The data collection instrument used for this study was a personal, semi-structured interview in the form of an interview schedule (Appendix 3). A face to face approach was used for local respondents while respondents based in other regions were interviewed via Skype. Semi-structured interviews were chosen as they allow flexibility to probe for more clarity on certain issues should the need arise. It also provided the rigour needed to compare the outcome of the interviews. Furthermore, unlike unstructured interviews, the interview schedule ensures that the respondents are kept on track and it maintains an order of consistency across all the interviews.

3.9.2 Interview design and preparation

The funnelling technique was used to design the questions in the interview schedule (Appendix 3). These questions addressed the objectives of the study and were developed by the researcher to address issues identified in the literature review. Initial questions were open-ended to gain a broad understanding of the software development situation of the company. This was followed with more focused questions on the skills and technologies employed by the company. Finally, questions relating to the ability of graduates in terms of these skills were included to extract more focused and precise information. The questions were designed such that no loaded questions were included. This promoted unbiased responses.

The interviewer conducted background research on the companies selected in the sample to gain an understanding of each company's operations. The participants were allowed to prepare by the researcher sending the questions to them a week in advance of the interview. While familiarising themselves with the questions, participants had sufficient time to withdraw from the study should they have found the questions to be inappropriate.

Three pilot interviews, with individuals performing similar roles as the target sample but were not part of the final study, were conducted to remove ambiguity and enhance clarity of the questions. The average time of the interview was 20 minutes. Interviews with the participants were pre-booked as meetings via email. This was done at least a week in advance in order to give interviewees the flexibility to reschedule if they were unavailable. Three interviews were rescheduled. Interviews conducted personally were held at the participants' offices as the familiar surroundings would allow them to be more relaxed and thus make the elicitation of information easier. Interviews held via Skype made the location irrelevant as the interviewee was at liberty to determine the location.

3.9.3 Reliability and validity

Kothari (2011) stated that validity and reliability are important tests that must be met by any research design. He defined validity as referring to the extent to which a test measures what we wish to measure, while reliability relates to the measurement procedure in terms of accuracy and precision. Although validity ensures correct measurement, reliability ensures that the transient and situational factors are not interfering (Kothari, 2011). Validity and reliability in qualitative studies differ from that used in quantitative studies (Morse, Barrett, Mayan, Olson & Spiers, 2008).

Validity is associated with accuracy (Hair et al., 2003). A subset of content validity known as face validity was the approach used to ensure validity of the instrument. Content validity “ensures that the measure includes an adequate and representative set of items that tap the concept” (Sekaran & Bougie, 2013). Face validity indicates that the concepts to be measured appear on the surface to be measured by the instrument. An inspection of the objectives and the related questions in the interview schedule confirms face validity of the instrument. Furthermore, validity in qualitative research refers to the extent to which the results accurately reflect the data collected (internal validity) and the results can be generalised or transferred to other concepts or settings (external validity) (Sekaran & Bougie, 2013, p. 351). Validity in this form was maintained by using event counts to support generalisations and by ensuring sufficient representation of cases and deviant cases as the need arose.

Reliability is associated with consistency (Hair et al., 2003). The instrument in qualitative research is the researcher and reliability thereof is based on the consistency of the research (Patton, 2002). Consistency across the interviews was achieved by using semi-structured interviews guided by an interview schedule that was strictly adhered to. Furthermore, the interviewer was active in the software development environment and understood the technical jargon and colloquial terms used in the industry. This ensured that appropriate follow up questions were asked to better understand issues that were unclear. Sekaran and Bougie (2013) stated that category reliability must also be maintained in qualitative research. Category reliability was achieved by ensuring that category definitions were appropriate to classify the data.

A further measure of practicality that refers to economy and convenience is also defined (Kothari, 2011). The interviews in this study were scheduled at the convenience of both the interviewer and interviewee and in such a manner as not to impose on the interviewee’s functions and duties in their organisation. Interviews outside of KZN were conducted via Skype, thus keeping expenses to a minimum.

3.10 ETHICAL CONSIDERATIONS

Ethics in research ensures that the research activities do not cause any harm or suffering to anyone (Coldwell & Herbst, 2004). Furthermore, this is achieved by respecting the rights of individuals. Apart from relevant legislation, this is also dictated by societal norms at the

time. In order to ensure compliance, ethical clearance for this study was obtained from the University of KwaZulu Natal (Appendix 4). Gatekeeper's letters were obtained from all the participant companies. Furthermore, the individual participants were provided with all the information relating to the study. Participants signed a letter of consent prior to the commencement of the interviews (Appendix 2). However, they were also informed of their right to withdraw from the study at any time. Permission to use a voice recorder was also sought for referral purposes and to facilitate more concise analysis of the data.

3.11 ANALYSIS OF THE DATA

Analysing qualitative data transforms it into findings (Patton, 2002). However, the challenge lies in taking the large chunks of unstructured data, structuring it and making sense of it. Figure 3.3 shows the basic qualitative data analysis process.

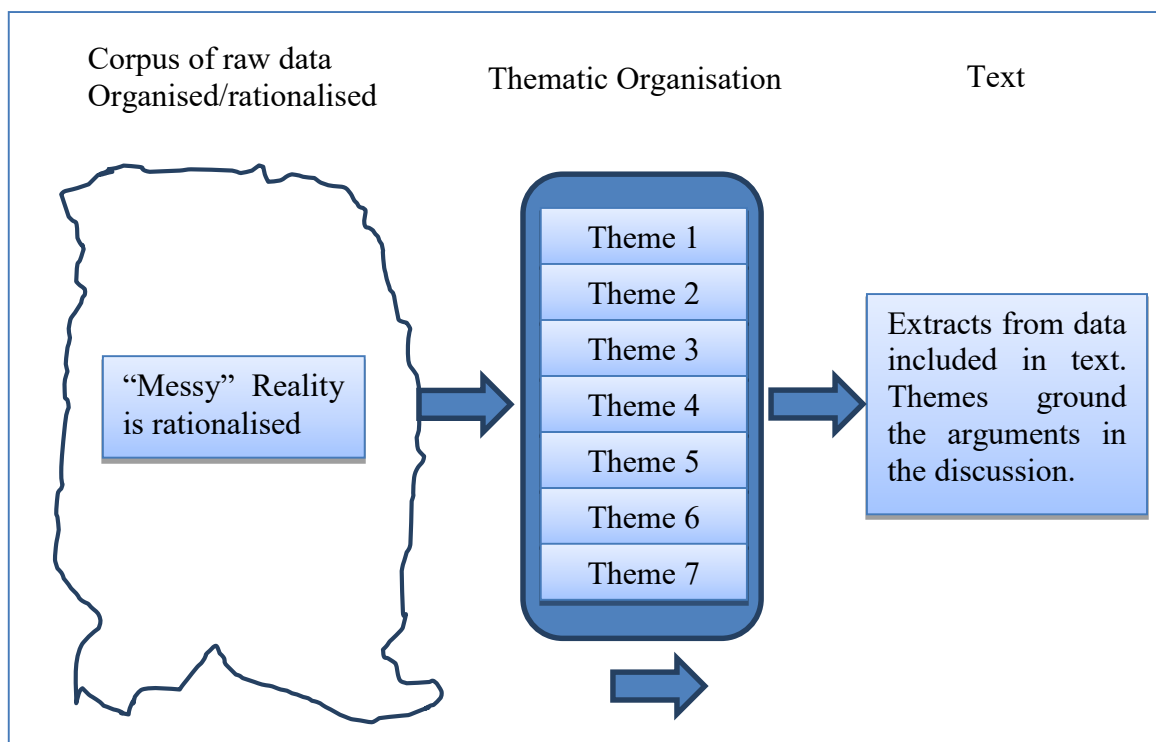


Figure 3.3: The qualitative data analysis process

Source: Adapted from Henning, E., Van Rensburg, W. & Smit, B. 2004. Finding your way in qualitative research, Pretoria, Van Schaik.

Patton (2002) described the steps in Figure 3.3 as reducing the volume of raw data, extracting significant data, identifying significant patterns and constructing a framework to present the data and conclusions.

Data for this research consisted of the recorded interviews and the completed schedules, including notes taken during the interview. In order to facilitate a smooth data analysis process, NVIVO, a software tool designed for qualitative analysis, was used. The first step in the process was the reduction of data. This included a process of coding that incorporated elimination of unnecessary or irrelevant data, rearranging the data and integrating it to form theory (Sekaran & Bougie, 2013). During this process each topic was assigned its own unique node within NVIVO. This was followed by categorising which is the process of categorising, arranging and classifying the coding units described previously. Both inductive and deductive methods were used to generate the nodes.

The information obtained from the above process was analysed for patterns and relationships. In order to refine the findings, an iterative approach to coding and categorising was used with categories and coding variables modified through each iteration. This was necessary as new categories were identified during the analysis process.

3.12 SUMMARY

This chapter provided a brief outline of the research process incorporated in the research methodology adopted by this study. The aim and objectives of the study were followed by a comprehensive design of the qualitative approach followed for this research. This included the sampling technique used, sample frame referenced and the size of the sample. A data collection strategy was then motivated culminating in the analysis methods that were adopted.

The analysis, presentation and discussion of the data collected using the instrument discussed in this chapter follows in the next chapter.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.1 INTRODUCTION

The data for this study was collected in accordance with the guidelines of Chapter Three. All respondents agreed and allowed the interviews to be recorded. These interviews were transcribed and prepared for analysis and presentation which is the aim of this chapter. The data is presented by initially describing the themes that were evident in the responses to the questions. This is followed by the interpretation, conclusion and theorisation brought about from the extraction of the themes.

4.2 DESCRIPTION OF PARTICIPANTS

A description of the participants is relevant in a qualitative study as it induces quality and credibility of the participants as experts in the field.

The participants included eight managers, one senior manager, one director and one executive. Although their roles were diverse, all maintained a common thread as at the time of the research they were involved in the graduate recruitment activities and graduate programme of their respective companies. This provided them with first-hand experience about the challenges faced by industry in recruitment, upskilling and management of the ICT graduates. Three of the participants served on advisory boards of various universities while a few participants also undertook guest lecturing duties at several higher education institutions. Some of the participants also provided mentoring to graduates at some point in their career. Experience in the ICT sector that included mentoring and graduate involvement ranged from five years to 17 years. All participants also had a human resources background as would be implicit for any individual involved in graduate programmes. The ICT and human resource experiences of the participants provided a perfect combination for them to participate in this study.

It is evident from the above demographic data that the participants were experts and well positioned to provide rich, relevant and insightful data for the study.

4.3 STUDY FINDINGS

The data collected was analysed through an iterative process initiated by the identification of themes from the data. This data was then categorised within the themes with the resultant structured data forming the platform for the presentation of results. Direct quotations of participants were used to provide clarity and evidence to support the findings of the data reduction and analysis process. A description of the data for each objective is provided followed by the interpretation and conclusions that resulted from the data.

4.3.1 Objective one – Job Roles

To establish the type of job roles employed within software development companies.

Objective one aims to provide an understanding of the job roles that are employed within companies that provide software development services. It is important that an overview of possible graduates' roles is understood to ensure that the skills are commensurate. A funnelled approach to this objective was adopted with respondents providing an overview of the ICT services followed by the specific software development functions provided by the company. Furthermore, the roles that ICT graduates were expected to perform within software development was identified.

4.3.1.1 Question 1 – ICT services provided in-house

What ICT services does your organisation provide or perform in-house?

The key themes identified included software; hardware and infrastructure; database; administration and maintenance; training; and consulting. Table 4.1 shows the participant companies' involvement in these various facets of ICT.

Table 4.1: Participant companies' ICT offerings

What ICT services does your organisation provide or perform in house?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company J	Company K	Company I	Total
Administration and maintenance	✓	✓	✓	✓	✓	✓	✓	-	✓	-	✓	9
Consulting	-	-	-	-	-	-	✓	-	-	-	-	1
Database	-	-	✓	✓	-	✓	-	-	-	-	-	3
Hardware and infrastructure	-	✓	✓	-	✓	✓	✓	✓	-	-	✓	7
Software	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Training	-	✓	-	-	-	-	✓	-	-	-	-	2

Table 4.1 importantly indicates that all participant companies provide a software development function which formed the basis of this research. Other services provided by the companies include hardware and infrastructure; databases; and administration and maintenance. As is evident from the table, these companies perform very few consulting and training services.

4.3.1.2 Question 2 – Software development functions provided in-house

What software development functions do you provide or perform in-house?

The software development functions included the typical aspects of the software development cycle. This is illustrated in Table 4.2.

Table 4.2: Software development functions offered by participant companies

What software development functions do you provide or perform in-house?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Design	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	10
Analysis	✓	-	✓	✓	✓	✓	✓	-	✓	✓	✓	9
Testing	-	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	9
Maintenance	✓	✓	✓	-	✓	-	✓	-	-	-	✓	6

Table 4.2 reinforces the participants' offerings within software development and shows that a majority provide analysis, design, programming and testing functions. Only six participants provide maintenance functions and this is only done for solutions developed by the companies themselves, as noted by some of the participants below:

Company B: "...Maintenance and support, we basically maintain the systems that we provide and support them...."

Company E: "...obviously post development, we've had all the support and future maintenance...."

4.3.1.3 Question 3 – Functions fulfilled by graduates

Which of these functions do you envisage graduates to fulfil?

Table 4.3 identifies the functions of software development that graduates were fulfilling.

Table 4.3: The role of graduates in software development

Which of these functions do you envisage graduates to fulfil?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Analysis	✓	-	-	-	✓	-	-	-	✓	-	-	3
Design	✓	-	-	-	✓	-	-	✓	✓	-	-	4
Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Testing	-	✓	-	-	-	-	-	✓	✓	-	✓	4

It is evident from Table 4.3 that all graduates had a role to play in programming. Roles in analysis, design and testing were minimal.

4.3.1.4 Discussion of objective one

Objective one was to establish the type of job roles employed within the software development companies. Figure 4.1 provides an overview of the prevalent themes of objective one.



Figure 4.1: Word cloud overview of job roles within software development companies

It is evident from Figure 4.1 that although the companies provide a broad array of services, their key competencies are in software development. This is well captured by Company I's description of hardware services offered,

“Our core functions are development.... But as far as the larger clients go they'll have their own group IT that will make those kinds of decisions. Most of the time, if we are dealing with a smaller client that wants us to handle that side of things we'll go put it on the cloud...”

The cloud services referred to were outsourced to companies that hosted cloud applications.

When relating common roles to the functions described in Table 4.2, the job roles employed within software development are business analysts, software architects, software engineers, software developers and quality assurance testers.

The role of ICT graduates

Evidence from Table 4.3 suggests that the graduates' roles were limited to software development where the core task is programming. As Company K stated,

“...they wouldn't really build the spec and especially in the early days...work in a tight framework of here's the spec, make sure you understand it... do all the coding and the unit testing...”

The implication is that the graduates are not tasked with specifying the solution for the project. They are instead given the specification and are only tasked with programming. Graduates are not expected to perform roles in the other functional areas due to the experience required. This was well captured by Company F,

“...mostly target the core development...we don't expect them to start as architects as it is a senior role and people must progress into it, so it is project managers...”

Although maintenance does not feature as a theme, should maintenance such as bug fixes incorporate programming, the graduates will be involved which in turn will strengthen the assertion that the core role of the graduates was programming. Company G stated,

“They also involved in the faults side...the fault is, he identifies the problem and fixes it, goes to the support for test... There's no analysis and design, etc...”

Consistent with the MICT SETA's Sector Skills Plan introduced in the literature review, it is evident that companies are recruiting graduates to fulfil roles in programming. This augers well for the sector as it aims to alleviate the skills shortage burden in this facet of the ICT sector as identified by the MICT SETA.

4.3.2 Objective two – Technical knowledge and skills

To identify the technical knowledge and skills required by the ICT software development sector.

The second objective of the study was to identify the technical knowledge and skills required within the ICT software development sector. The aim of these questions was also to create a point of reference when analysing the knowledge and skills that the graduates brought to industry. Two questions about the technical knowledge and technical skills required by the participant companies were asked.

4.3.2.1 Question 4 – Technical knowledge

What technical knowledge do you expect an ICT graduate to possess?

Figure 4.2 provides an overall view of the key words that participants used to answer this question. It is evident that the key themes would be derivatives of programming, the web and databases.



Figure 4.2: Word cloud overview of technical knowledge expected from ICT graduates

Closer inspection of Figure 4.2 in conjunction with the participants' answers to this question revealed the following key themes, illustrated in Table 4.4.

Table 4.4: Technical knowledge expected of ICT graduates

What technical knowledge do you expect an ICT graduate to possess?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Object-oriented programming	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	-	9
Relational databases	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-	9
Web development	✓	✓	-	-	✓	-	-	-	✓	✓	✓	6
Frameworks	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	7
Methodologies	-	-	✓	✓	✓	✓	-	-	-	✓	✓	6
Testing	✓	-	✓	-	-	-	-	✓	✓	-	✓	5
Maths	-	✓	✓	-	-	-	-	-	-	✓	-	3

The technical knowledge valued the most was object oriented programming, relational databases and web development. The object-oriented programming knowledge is consistent with the concept identified from the MICT SETA's Sector Skills Plan in the literature review.

4.3.2.2 Question 5 – Technical skills

What technical skills do you expect an ICT graduate to possess?

Following on from the knowledge, the skills that an ICT graduate is expected to possess are illustrated in Table 4.5.

Table 4.5: Technical skills expected of ICT graduates

What technical skills do you expect an ICT graduate to possess?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Java	✓	✓	✓	✓	✓	✓	-	-	✓	-	-	7
Microsoft .net	✓	-	✓	✓	✓	✓	-	-	-	-	✓	6
SQL	-	-	✓	-	✓	✓	✓	✓	-	-	-	5
Javascript	✓	-	-	-	-	✓	-	-	✓	✓	-	4
Oracle	-	-	✓	✓	-	-	✓	✓	-	-	-	4
HTML	✓	✓	-	-	-	✓	-	-	✓	-	-	4

The technical skills in high demand are Java and Microsoft .net. This is followed by SQL, Javascript, Oracle and HTML. These are reliable and robust technologies that are the industry standard in all types of development, including web applications, windows applications, databases and to a certain extent mobile development as well.

4.3.2.3 Discussion of objective two

There is a direct correlation between the technical knowledge and skills that an ICT graduate is expected to possess, and although some participants did not see the necessity of certain knowledge requirements, these were contradicted in the skill requirement of the ICT graduates as discussed below.

Object-oriented programming: Java is an object-oriented language while Microsoft .net also has an object-oriented component to it in the form of C# and other .net programming languages. Although Company E did not indicate that object-oriented programming knowledge is expected, Java was indicated as an expected skill set. This, however, is mitigated by the following statement,

“...as well as potential frameworks, software frameworks that they can use to present front ends and things like that...”

Within this context, the appropriate software frameworks would also incorporate object orientation. The reverse is true for Company H and J whereby object-oriented programming knowledge is expected but no specific skill set in a programming language was mentioned.

Relational databases: SQL and Oracle themes in the expected skills provide confirmation of the relational database aspect of the expected knowledge. Companies A, B and I indicated that relational databases knowledge is expected but they did not indicate what aspects of database skills sets are expected.

Web development: Javascript and HTML endorse the requirement of web development knowledge. Furthermore, Java and Microsoft .net also have web components. Java provides the backend of various web frameworks such as Java Server Pages (JSP), Enterprise Java Beans (EJB) and Wicket. Microsoft .net on the other hand also has its ASP.net web framework. C# and the other .net languages provide the backend functionality to ASP.net.

In the literature review, Lauder et al. (2012) argued that academic knowledge provide the generic skills required for work. The analysis of the knowledge and skills that ICT graduates are expected to possess is consistent with Lauder et al. (2012). This is further emphasized by the following statements by Company A and B respectively,

“...So I think most of the kids are learning an object-oriented approach which is fine, we can work with that...”

“...I would just say that for us the most important thing is being able to or understanding programming in the sense that it doesn't matter what language they pick up...”

This shows that the knowledge of object-oriented programming and programming in general that is obtained at university is sufficient to enable a graduate to learn any programming language, the skill, in the workplace.

4.3.3 Objective three – Soft skills

To identify the soft skills desired within the ICT software development sector

The third objective of the study was to identify the soft skills that an ICT graduate should possess. The aim of this question was to identify if graduates should possess any soft skills to complement the technical skills and knowledge. An understanding of the value placed on soft skills was also sought.

4.3.3.1 Question 6 – Soft skills expected

Apart from technical proficiency, what other skills do you expect an ICT graduate to possess?

The themes that emerged from the analysis were the ability to problem solve and be analytical; team work; communication; work place etiquette; and to a much lesser extent, business knowledge and acumen. A theme that seemed to recur quite often was that of understanding. These themes are illustrated in Table 4.6.

Table 4.6: Soft skills expected of ICT graduates

Apart from technical proficiency, what other skills do you expect an ICT graduate to possess?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Problem solving and analytical	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Team work	-	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	9
Communication	-	✓	-	✓	✓	✓	-	✓	✓	✓	✓	8
Work place etiquette	✓	✓	-	-	✓	✓	✓	-	-	✓	✓	7
Understanding	-	✓	✓	✓	-	✓	✓	-	✓	-	-	6
Business knowledge and acumen	-	✓	-	✓	-	-	-	✓	-	-	-	3

It is evident from Table 4.6 that the dominant theme was problem solving and being analytical. The competency paradigm of skills of Lauder et al. (2012) is based on a combination of technical and soft skills to perform a job. There was strong evidence to support this view, as being analytical and having the ability to problem solve has been identified as a “grounded skill” rather than a soft skill. The following excerpts of participants’ responses provide justification of this view:

Company A: "...they need to learn to solve the problems that they dealing with cause programming is problem solving and every problem has a hundred different approaches of solving it..."

Company B: "...if you in IT you are a problem solver from the beginning. Actually more than 90% of the people we see have to have that ability. It's right up on the top of the list. More a core skill rather than a soft skill or add on..."

Company J: "...I would probably associate that (problem solving) with the technical proficiency than a soft skill reason being there must be an aptitude, a problem solving aptitude a developer or a person that goes and studies and works must have. It's a grounded skill that, they, without that I don't see how they can survive..."

Apart from this, the statements below of Company A and G respectively reaffirm the value of soft skills as not merely complementary but core to the graduates' ability:

"...But if you've got fantastic qualifications and the wrong attitude then we try and get rid of you as quickly as possible..."

"...the thing is, if you do not know how to program..., I can send you for the training but if you do not have the basics like work ethics. ...then this is not going to work. I can't make you do those things. ...it comes from your mind and you'll have to do that on your own..."

Although nine of the participants rated team work highly, there is a mixed view from some of the participants in this regard. Company C stated:

"...are they a team player. If it comes out that they not, we don't decline them because of that aspect... we got different team sizes and depending on the individual, they'll fit into a scenario..."

Although eight participants indicated that good communication skills are required, there were no negative comments regarding communication. Company C, who disagreed with team work, also agreed that communication skills are desirable:

"...It's always a bonus to have communication..."

Company A, E and K respectively articulated the essence of work place etiquette when stating the following:

“...we look for mostly is a fit with our culture, a good attitude and a good work ethic and a willingness to learn and a willingness to take initiative...”

“To be professional, we are in an office environment, we certainly don’t expect you to dress in a suit ... we do expect you to maintain a level of professionalism and with that comes respect you know for everyone, silence, I mean it’s not a party place...”

“...it sounds like really basic stuff but they've actually just got to know how to do some basic things, come dressed respectably to the office...”

The theme of “understanding” also featured prominently as six of the participants mentioned it as a soft skill that is desired. To understand means to have “a mental grasp” or the “power of comprehending” (Merriam-Webster.com, 2015). This soft skill has a direct correlation with both problem solving and analytical as well as communication. It stands to reason that the graduates will only be able to solve a problem when they grasp and are able to comprehend the situation or issue that needs resolving. This would involve communication, both verbal and written, that must be understood otherwise something that is not the actual problem may be dealt with.

4.3.4 Objective four – Gaps in knowledge

To establish the gaps in ICT graduates’ knowledge.

The fourth objective of this study was to establish the gaps in ICT graduates’ knowledge. A funnel approach was used to gain insight into this objective. The questions asked aimed to provide an understanding of whether there was difficulty in recruiting skilled ICT graduates leading up to the skills that graduates brought to industry from university. The last two questions of this objective then established the gaps and the reasons for the gaps in ICT graduates’ skills and knowledge.

4.3.4.1 Question 7 – Ease of recruitment

How easy is it to recruit skilled ICT graduates?

The ease with which companies are able to recruit skilled ICT graduates provides a good indication of the general consensus regarding the knowledge and skills that graduates bring to industry. The interviewer ensured that participants were made aware of the emphasis on “skilled” so as to attract appropriate responses. This question is qualitative in nature and provided the broad picture which is in line with the funnel approach taken for this objective. Figure 4.3 illustrates the responses to this question with nine participants responding that it is difficult to very difficult while two felt it was easy and two were unsure.

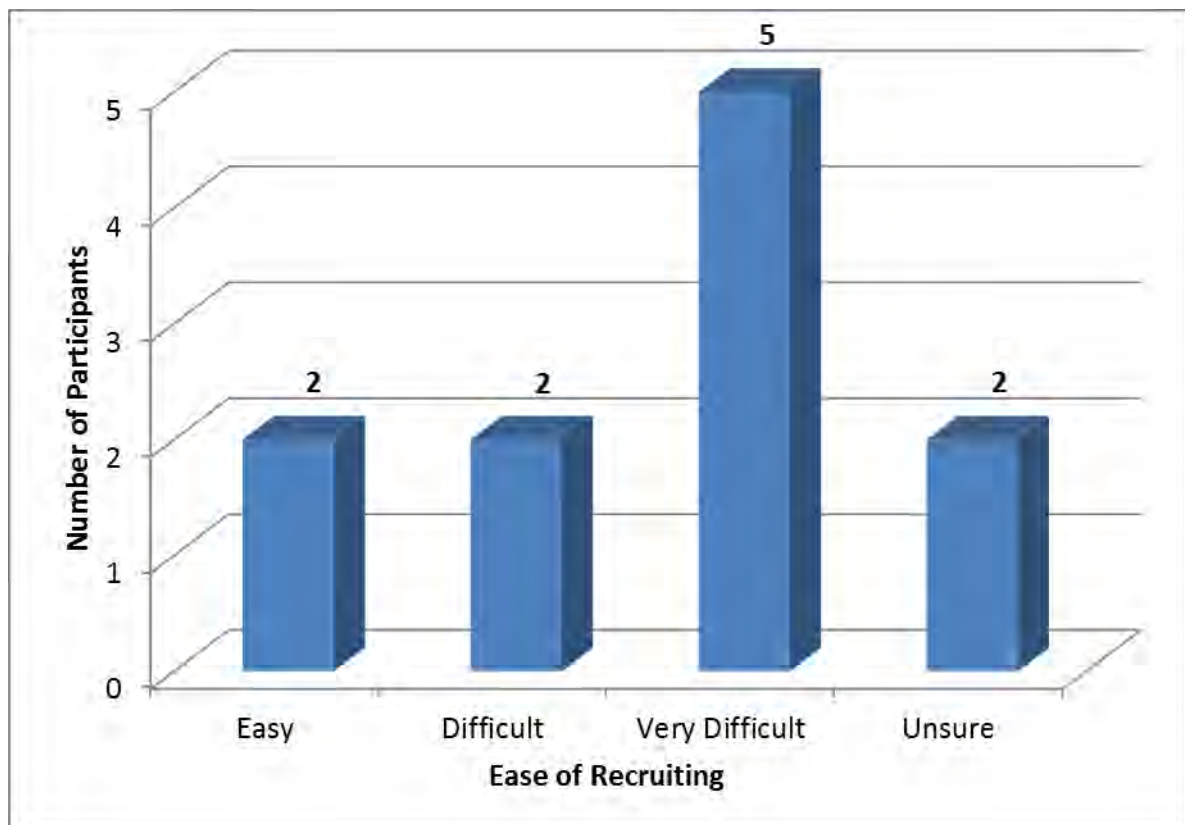


Figure 4.3: Ease of recruiting skilled ICT graduates.

It is evident from Figure 4.3 that recruiting skilled ICT graduates is very difficult. This implies that the graduates are not attaining industry relevant skills at the higher education institutes. The implication of this is that Outcome 4.2.3 of the National Skills Development Strategy III, as discussed in the literature review, is not being met. Outcome 4.2.3 states “High level national scarce skills needs are being addressed by work ready graduates from higher education institutions”. The analysis of the questions that follow provides deeper insight into the reasons why this is the case.

4.3.4.2 Question 8 – Skills possessed by graduates

What skills do the ICT graduates bring into the organisation?

The dominant theme of this question was that the graduates possess a sound theoretical base. However, this theoretical base did not translate into skills as five of the respondents highlighted that the graduates bring little or no skills into the organisation. Four participants indicated that some basic programming and coding skills are noticed while the other minor themes included tool sets, energy, problem solving and research. Table 4.7 provides an overview of the participants' responses to this question.

Table 4.7: The skills ICT graduates bring to the organisation

What skills do the ICT graduates bring into the organisation?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Theoretical	-	✓	-	✓	✓	✓	✓	-	-	-	✓	6
Little or no skills	✓	✓	-	-	-	✓	-	-	-	✓	✓	5
Basic programming and coding	✓	-	✓	-	-	-	✓	-	-	-	✓	4
Tool sets	-	-	-	-	-	✓	-	✓	✓	-	-	3
Energy	-	-	-	✓	-	✓	-	-	-	-	-	2
Problem solving	-	-	✓	-	-	-	-	-	-	-	-	1
Research	-	-	-	✓	-	-	-	-	-	-	-	1

Although this question focused on skills, the extraction of theoretical knowledge as the dominant theme indicates that it is an area that is successful. However, the theme of graduates bringing little or no skills to the workplace but having a strong theoretical base supports the perspective of Brown et al. (2011), namely that being highly skilled is not an implicit by-product of being highly qualified. Furthermore, this evidence also contradicts the view of Lauder et al. (2012) and van der Werfhorst (2011) which is that academia are the foundation of skills.

4.3.4.3 Question 9 – Gaps in skills and knowledge

What are the common gaps in ICT graduate skills and knowledge?

The lack of practical experience and exposure is lamented by industry. This is the major theme in this question with ten of the participants in agreement. Soft skills and design skills are also revealed as shortcomings. Understanding also features in this question as it did in the soft skills section above. The other themes received less than three responses and included problem solving, mobile development, testing, web development skills and version control. Table 4.8 shows an overview of the participants' responses to this question.

Table 4.8: Gaps in ICT graduate skills and knowledge

What are the common gaps in ICT graduate skills and knowledge?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Lack of practical	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	10
Soft skills	-	-	-	✓	✓	✓	✓	-	-	✓	-	5
Design skills	-	✓	-	✓	-	-	-	-	✓	✓	-	4
Understanding	✓	-	-	✓	-	-	-	-	-	✓	-	3
Problem solving	-	-	✓	✓	-	-	-	-	-	-	-	2
Mobile development	-	✓	-	-	-	-	-	-	-	-	-	1
Testing	✓	-	-	-	-	-	-	-	-	-	-	1
Web development skills	-	✓	-	-	-	-	-	-	-	-	-	1
Version control	-	-	-	-	✓	-	-	-	-	-	-	1

The lack of practical experience and exposure is consistent with the dominant themes discussed in the previous question. The central role that graduates are expected to fulfil, as noted in Section 4.3.1.2 above, is programming which has a strong practical bias to it. Therefore, even though the graduates are qualified by virtue of their completed degree or diploma, they do not possess the skills required by industry. This is consistent with Brown et al. (2011) who found that being highly skilled is not an implicit result of being highly qualified. The essence of this gap is well captured by the following participants:

Company B: "...I don't think on the knowledge side there's a gap right. I think they come out with all the knowledge that they need. On the skills side they putting it into practice is a gap"

Company G: “They more technical the learners and even at DUT, do they focus a lot on the practical side?”

Company J: “I think the gap between academic and industry relevant knowledge.”

Company K: “...the disconnect between what they've learnt at university to what's actually in industry.”

The point was further emphasised by Company K who stated:

“...as an employer if I had two candidates coming to me and the one went from high school into the work environment and learnt how to program in a company for three years or someone who went from high school to university and did a programming degree for three years, I would take the first guy ... got three years of experience because he is definitely going to be a better developer than the guy who spent three years in a university.”

Evidence of four high order categories defined in the employability model by Finch et al. (2013) is found in the responses to this question. The problem-solving and soft skills categories are self-evident. The job-specific functional skills category is reflected in the lack of practical experience exhibited by the graduates. The categories that do not feature are pre-graduate experience and academic reputation.

Discussions on the reasons for these gaps follow.

4.3.4.4 Question 10 - Reasons

What are the reasons for the gaps?

The reasons attributable to the gaps are identified as the nature of the industry; supply and demand mismatch; the inflexible nature of the university curriculum; and the theoretical focus of higher education institutions. Table 4.9 indicates the participants' responses to this question based on these themes.

Table 4.9: Reasons for the gaps in ICT graduate skills and knowledge

What are the reasons for the gaps?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Nature of the industry	✓	✓	-	✓	-	✓	✓	-	-	✓	✓	7
Supply demand mismatch	-	-	✓	-	-	✓	-	✓	✓	✓	✓	6
Inflexible nature of university curriculum	✓	✓	-	-	-	-	-	-	✓	✓	✓	5
Theoretical focus of higher education institutions	✓	-	-	-	-	-	✓	-	✓	-	✓	4

The nature of the industry as the dominant theme here confirms that the constantly evolving ICT environment poses significant challenges in developing skills for the sector. This is consistent with the assertions by Lotriet et al. (2011) as outlined in the literature review. The following statements capture the essence of this theme:

Company A: “...I guess things change fast...you know things move on and they (the universities) are a little slow to adapt ...”

Company J: “...reason for the gap is I believe in industry, we've moved way faster than academia does.”

Company K: “...a lot of the stuff they being taught is outdated...”

The unacceptable lag between the time that changes in industry occur and when these changes are acted on by the education and training institutions is the foundation of the second theme which is the supply and demand mismatch. This occurs when the demands of the industry are not aligned with those of the education and training institutions. Here again, there is support for Lotriet et al. (2011) who advised that this was inevitable due to the constant change inherent in the industry. Company K captures this sentiment succinctly:

“...and the disconnect between what they've learnt at university to what's actually in industry ...”

Five participants cited the inflexible nature of the university curriculum as a problem. Interestingly, all five also cited the nature of the industry as a contributing factor. Hence it is concluded that the lack of flexibility in the university curriculum results in a delayed response to changes that occur in industry, which is the foundation of the supply demand gap. This is exacerbated by the ever-evolving nature of the ICT industry.

The theoretical focus of higher education institutions was identified as a factor by four participants. This stands to reason as all of these participants also related to the lack of practical ability identified in the previous question.

4.3.4.5 Summary of objective four

The key gaps in the skills and knowledge of the graduates related to practical experience and exposure, soft skills, design skills and an understanding mind set. The key reason for the gaps is the inflexible nature of the curriculum causing a mismatch between supply and demand which is worsened by the constantly evolving ICT industry. This results in the industry finding it extremely difficult to recruit skilled ICT graduates.

4.3.5 Objective five – Employers contribution to job readiness

To investigate what employers are doing to get their ICT graduates job ready.

This objective investigated what employers were doing to get their graduates' jobs ready. This was done by gaining an understanding of the skills training employers provided to the graduates while also gaining insight into who funded these initiatives. An understanding of the length of time it takes before a graduate is deemed competent was also sought.

4.3.5.1 Question 11 – Skills training provided

What skills training does your organisation provide to ICT graduates?

The skills training that employers provide to graduates includes both technical and soft skills training. Many participants also indicated that they provide little or no training at all. Other forms of training include methodologies, performance management and project management. Table 4.10 provides an overview of the type of training provided by the participants' organisations.

Table 4.10: Skills training provided to graduates

What skills training does your organisation provide to ICT graduates?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K	Total
Soft skills	-	✓	✓	✓	-	✓	✓	-	✓	✓	-	7
Technical skills	-	✓	✓	✓	-	-	✓	-	✓	-	-	5
Little or no training	✓	-	-	-	✓	-	-	✓	-	✓	✓	5
Methodologies	✓	-	-	-	-	-	-	-	-	-	-	1
Performance management	-	-	-	✓	-	-	-	-	-	-	-	1
Project management	✓	-	-	-	-	-	-	-	-	-	-	1

It is evident from Table 4.10 that technical and soft skills were targeted for improvement through formal training. Five of the companies provide little or no training. A discussion of these three dominant themes within skills training follows.

Soft skills: Figure 4.4 illustrates the type of soft skills training that is usually provided to the graduates.



Figure 4.4: Word cloud overview of soft skills training provided to graduates

It is evident from Figure 4.4 that soft skills training efforts are focused on time management. The other facets of training include teamwork, communication and work etiquette. With the exception of time, the provision of soft skills training in the areas identified above is consistent with the organisation's soft skills wish list of graduates, as

identified in Section 4.3.3.1 above. Although time does not feature in that wish list, it stands to reason that this will be a desired skill due to the contract nature of work performed by the participant companies. Hence, proper timekeeping is essential to ensure proper billing and to create a database of effort in order to assist with estimates and quotations for future contracts. The absence of problem solving and analytical training reiterated the assertion that it is a core skill that is highly sought and graduates who lack in this area are not considered for positions in this environment.

Technical skills: Consistent with the finding in Section 4.3.4.1 above whereby graduates bring theoretical and little or no skills to industry, training in technical skills is appropriate. Figure 4.5 illustrates the technologies that make up the technical skills training package for the graduates.



Figure 4.5: Word cloud overview of technical skills training provided to graduates

Evidently the main technologies are Oracle, Microsoft .NET, Java and SQL. These are four of the top five technical skills that industry expects ICT graduates to possess, as identified in Section 4.3.2.1. On closer inspection it is evident that the other two skills, web and HTML, also appear here albeit on a smaller scale to the other four technologies. This training is consistent with Schofield's (2014) finding that Java, C# and .NET are technologies that are in high demand.

Little or no training: Although providing little or no training may seem counter-intuitive to the goal of getting the graduates up and running as soon as possible, the general

exposure that the industry offers graduates to the workplace is sufficient to address the core gap identified in Section 4.3.4.1 which is the lack of practical experience and exposure. The graduate is provided with an internship experience as described by Renganathan et al. (2012) where the graduate is able to combine knowledge gained in the classroom with the real world of work. This internship type of experience will increase the employability of the graduates (Knouse and Fontenot, 2008; Binder et al., 2015).

4.3.5.2 Question 12 – Funding for training

Who provides funding for additional skills training?

The major funders of graduate training are the companies themselves. Six of the participants indicated that their organisations funded the graduates' training. However, five companies also tapped into the Skills Development Fund to recoup some of these costs from the levy paid into the fund. Table 4.11 illustrates the distribution of the sources of funding for graduates' skills training at the various companies.

Table 4.11: Source of funding for graduates' skills training

Who provides funding for this additional skills training?	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I	Company J	Company K
Not applicable								✓			✓
Skills Development Fund		✓		✓			✓		✓	✓	
Sponsors	✓	✓		✓							
The company			✓	✓	✓		✓		✓	✓	

Table 4.11 reveals another source of funding which is through sponsorships. Two of the participants are aligned to Microsoft and receive sponsored training for their graduates. However, this is only for Microsoft products and training. Another source of sponsorship is the Department of Trade and Industry which is where another participant obtains their funding.

4.3.5.3 Question 13 – Time spent on the programme

What is the average time period a graduate spends on the programme before being deemed competent?

Table 4.12 shows the average time taken for a graduate to become competent in the software development industry.

Table 4.12: Time period before being deemed competent

Months	Number of participants
>3 to <=6	3
>6 to <=9	3
>9 to <=12	3
>12 to <=18	2

As illustrated in Table 4.12, the training period varies considerably among the participants' organisations. It can take anything from three months to a year and half before a graduate is deemed competent. Another point of interest is that Company H does not send the graduates on any official training and competency is attained after 18 months. Conversely, Participants D, G and I provide graduates with technical skills training and have the graduates competent in six months, three to four months, and four and half months respectively. However, this topic does not fall within the ambit of this research and is a topic for future research.

4.3.5.4 Summary of objective five

Organisations are expending the necessary effort to get ICT graduates ready. Companies provide or source the funds to get the graduates trained in soft skills and the specific technologies. Intangibles such as the provision of a mentor, office space and equipment must also not be underestimated as indicated by the "Little or no training" section above. The funding mechanisms adopted, including the organisation bearing the cost of training, use of the Skills Development Fund and sponsorships. The graduates are deemed competent after a period ranging from three months up to 18 months. A correlation between training and time to competency may exist but is a topic for future research.

4.3.6 Objective Six – University/College curriculum amendments

To establish what amendments need to be made to the university/college curriculum.

Objective six sought to establish what amendments are needed in the university or college curriculum. This was achieved by the use of three quantitative questions followed by a qualitative question on what changes to the curriculum the participants would prefer.

4.3.6.1 Question 14 – Change the curriculum

Would you prefer the graduate curriculum to be changed?

Figure 4.6 illustrates the collective results of whether the ICT graduate curriculum should be changed.

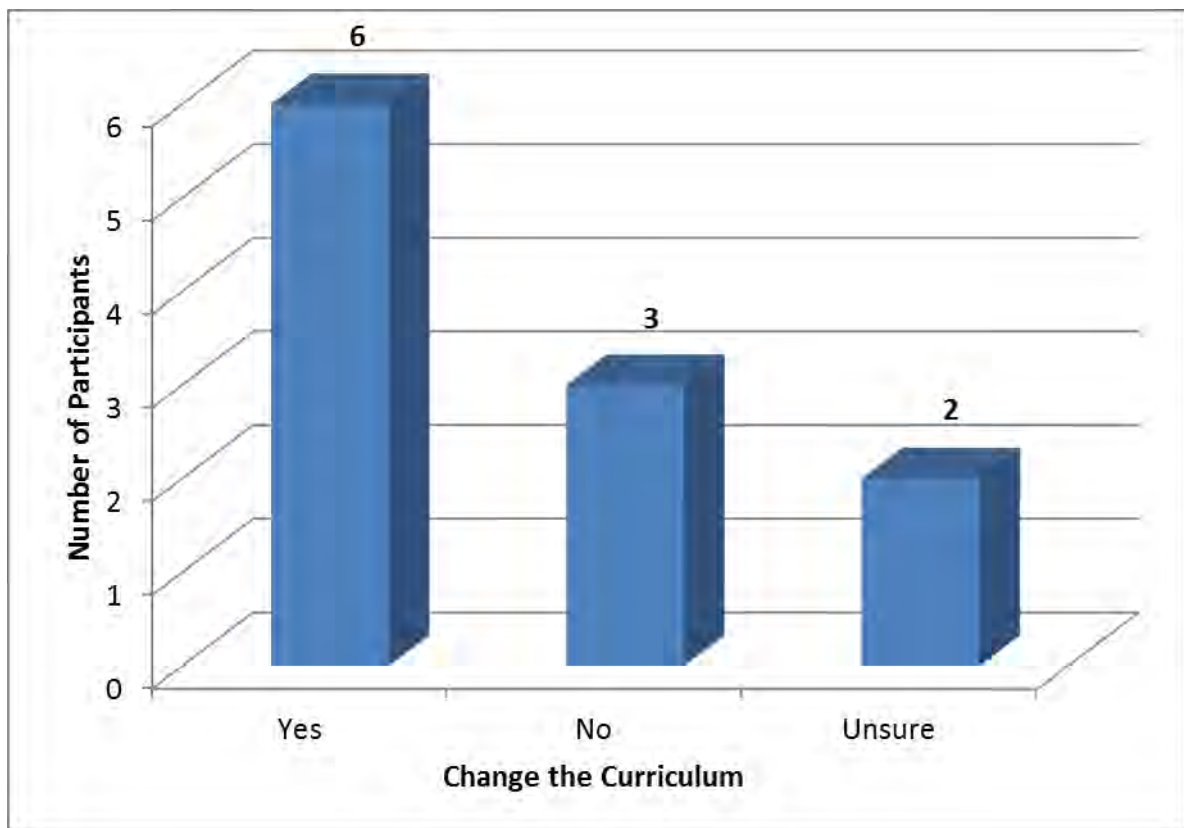


Figure 4.6: Should the ICT graduate curriculum change?

It is evident from Figure 4.6 that the ICT graduate curriculum should change. Only three participants felt that it should not change while two were unsure.

4.3.6.2 Question 15 – Approached by DHET

Has your company been approached by the Department of Higher Education and Training with a view to provide input into the ICT graduate curriculum?

All 11 participants responded that they were not approached by the DHET to provide input into the ICT graduate curriculum. This indicated a lack of proper mechanisms within government to probe industry on its requirements.

4.3.6.3 Question 16 – Approach the DHET

Has your company approached the Department of Higher Education and Training with a view to provide input into the ICT graduate curriculum?

Ten participants responded that their company has not approached the DHET to provide input into the ICT graduate curriculum. One participant was unsure. This provides evidence that there is also a lack of drive from industry to address the issues that they are facing. There is no effort expended in raising the disconnect between industry requirements and what the graduates are acquiring.

4.3.6.4 Question 17- Changes to the curriculum

What changes to the curriculum would you recommend?

The essence of changes that the participants would like to see in the curriculum is well captured by the participants' remarks below:

Company B: "...see more practical being done..."

Participant D: "...it's more exposure into how businesses utilise applications."

Company F: "What I think should be encouraged is that each student doing his third year must be placed in a company for them to understand and maybe multiple companies..."

Company G: "...get them as a graduate in the third year, assign them to (Company B) for 3 months, and see how they can help the organisation in certain of the things that they doing..."

Company J: "Introduce a fourth year that is your technical experience."

Company K: "...more real life stuff that they doing and practical skills... go and build a solution for a local charity and actually implement it and actually trouble shoot and get the user trained and have some working real life system at the end of it. "

It is evident that the change that industry requires is better and more practical exposure.

4.3.6.5 Discussion of objective six

The responses above reflect a lack of input from industry in the curriculum development for the ICT faculty. Although, at the time of this research, changes in the curriculum were needed, no known mechanism for industry players to provide input into curriculum development of the Higher Education Training Institutions existed. However, participants did point to advisory roles performed in advisory boards of some institutions but this lacked the penetration required to bring about holistic change as it pertained to the individual institutions only. The "triple helix approach" (Etzkowitz & Leydesdorff, 1995) discussed in the literature review bears mention as it is revealed that a disconnect exists between industry and government, as evidenced by the questions above relating to the provision of input in the university curriculum. Doret and Johan (2014) concluded that South Africa's manifestation of the triple helix in the form of THRIP has been beneficial to innovation as well as other facets. This was identified and discussed in the literature review. Although several challenges exist in the programme, improvements in collaboration between industry, government and the universities could be achieved through more programmes of this nature.

4.4 SUMMARY

The data obtained from the 11 interviews was presented in this chapter. Visual data presentation formats such as tables, word clouds and graphs were combined with discussion and relevant quotes from the participants to analyse and present the data. Improved coherence was achieved by grouping the results by objectives. Themes within each question under the objectives were identified and the dominant themes of each question were analysed and discussed. These culminated in a discussion or summary of the related objectives. Some of the salient findings included the lack of practical ability and soft skills of the graduates. Furthermore, there is a lack of collaboration between

government, industry and the universities. Chapter Five will present the recommendations for consideration by the various stakeholders in ICT graduate employability.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Skills development in any industrial sector is vital to ensure continuity of the sector within an economy. Neglecting this fundamental requirement can cost a country billions as the skill would have to be imported or the work outsourced internationally. This results in the loss of much needed employment opportunities which is not ideal in South Africa's unemployment-rife economy. The problem is exacerbated when the industry experiences constant and frequent change as is the case in the ICT sector. Ensuring a constant stream of employable graduates is one of the means available to ensure sustainability. This study aimed to explore the graduate employability of ICT graduates with specific reference to the software development industry. The objectives of the study were structured to provide key insight into the graduate employability concept as well as the roles that graduates perform in the software development industry in order to answer the research question. The data was gathered from software companies that have comprehensive graduate recruitment programmes. This chapter draws on the analysis and highlights the conclusions reached, while also focusing on the recommendations from the findings. The limitations of the study as well as recommendations for further research are also noted.

5.2 KEY FINDINGS

The insight, provided by the data, into graduate employability and the roles ICT graduates are expected to fulfil in the software development industry permitted several conclusions to be drawn. Although these conclusions cannot be generalised to the entire population, the information provided by industry experts in this field provided key insight into the adequacies as well as shortcomings that define the employability or lack thereof of the ICT graduates. Table 5.1 provides a summary of the key findings as related to the objectives of the study.

Table 5.1: Summary of key findings

	Objective	Finding
1	To establish the type of job roles employed within software development companies.	The job roles employed by software development companies were business analysts, software architects, software engineers, software developers and quality assurance testers. However, the graduates' roles were limited to software development where the core task is programming.
2	To identify the technical knowledge and skills required by the ICT software development sector.	The technical knowledge valued the most was object oriented programming, relational databases and web development while the technical skills in high demand were Java, Microsoft .net, SQL, Javascript, Oracle and HTML.
3	To identify the soft skills desired within the ICT software development sector.	Problem solving and being analytical was the dominant soft skill. This was followed by team work, communication, work place etiquette and understanding. Business knowledge and acumen also emerged as a soft skill that was desired, albeit to a much lesser extent.
4	To establish the gaps in ICT graduates' knowledge.	The key gaps identified in the knowledge and skills of the graduates related to practical experience and exposure, soft skills, design skills and an understanding mind set.
5	To investigate what employers are doing to get their ICT graduates to be job ready.	It was found that employers were expending the necessary effort to get ICT graduates ready. Companies provided or sourced the funds to get the graduates trained in soft skills and the specific technologies. Furthermore, employers also provided mentors, office space and equipment. Apart from sourcing funding from the Skills Development Fund and sponsorships, employers were also bearing the cost of training. The graduates were deemed competent after a period ranging from three months up to 18 months.

	Objective	Finding
6	To establish what amendments need to be made to university/college curricula.	The participants indicated that the major change needed in the curriculum was to incorporate better and more practical exposure. However, at the time of this research, no known mechanism for industry players to provide input into curriculum development of the Higher Education Training Institutions existed.

The findings of the objectives in Table 5.1 permitted the following conclusions to be drawn. The job roles employed in the software development sector, based on the functions provided by the companies, included business analysts, software architects, software engineers, software developers and quality assurance testers. It is a reasonable expectation from industry that ICT graduates be able to perform all these functions except business analysis as it is considered a stream on its own. However, this is not the case and the main role that graduates perform is that of a software developer with the core function of programming. This indicates a shortcoming as industry does not have the confidence to allocate graduates to these other functions. However, it does confirm the forecast of the MICT SETA's Sector Skills Plan (SSP) that the skill in high demand is software developers.

There is an alignment of technical knowledge between the requirements of industry and what the graduates possess. This is consistent with the finding that the graduates bring a strong theoretical foundation to industry. However, this is not the case with industry-relevant technical skills which are found to be lacking. This is compounded by the graduates' lack of relevant soft skills which industry requires. Confirmation of this was found in the difficulty that industry experiences in recruiting skilled ICT graduates. The major gaps in skills and knowledge are the lack of practical exposure and the lack of soft skills which are also the main focus of training initiatives by industry. The above is also in line with the MICT SETA's SSP on the sector skills demand forecast, with the SSP containing a much more exhaustive list as it is not limited to software development only.

The above argument, in conjunction with the employability model proposed by Finch et al. (2013) and the definitions of graduate employability proposed by Knight and Yorke (2004) and (Poropat, 2011), led to the conclusion that the ICT graduates do not possess all the

industry-relevant employability attributes and are not work ready. Aggravating the situation is the:

- ▶ constantly evolving nature of the industry;
- ▶ mismatch between skills supplied and demanded;
- ▶ inflexible nature of university curricula; and
- ▶ theoretical focus of higher education institutions.

However, of major concern is the lack of collaboration and communication between government, industry and the universities. This has the effect of amplifying any shortcomings that arise due to the abovementioned points.

5.3 RECOMMENDATIONS BASED ON FINDINGS

The recommendations are based on the findings of the objectives and the conclusion to the research. It is an attempt to put structures and plans in place to address the graduate employability problem faced by the ICT graduates and industry as a whole.

5.3.1 Improved collaboration

It is evident from this study that the key contributing factor to the lack of job readiness of ICT graduates is the non-existent collaboration between government and industry. Programmes such as THRIP have an indirect benefit of encouraging the collaboration required. Although the core mandate of THRIP is research and technology development, the indirect benefits to the employability of the students involved in the various projects within THRIP and the fostering of industry university relationships are well documented (Doret & Johan, 2014). Due to the pervasive and evolving nature of the ICT industry, an extension of THRIP dedicated to the ICT sector is required. As government is represented by the National Research Foundation, a triple helix approach is fostered.

5.3.2 More practical exposure

Another recommendation that deserves consideration is giving the students more practical exposure. This practical exposure could be achieved by ensuring graduates undertake compulsory work experience once they have completed their course work. Although this is practised at universities of technology, it is not a requirement at mainstream universities. The current project that students have to undertake in their final year of study is also not sufficient as the core benefit that comes with exposure to a company or business

environment is lost. Hence, a network of alumni who are involved in the industry should be created. These alumni should be assigned to project groups and play a mentorship role to the students while also managing the students' final year project. This will introduce a practical element from industry and thus provide the students with more of an industry feel during the course of the project.

5.3.3 More flexible university curriculum

As discussed, the lack of flexibility in the university curriculum has had the effect of universities lagging industry. Even if there was a solid industry university relationship, changes necessitated by innovation and adoption of new technologies in industry would still be hard to implement. Hence, mechanisms need to be in place to ensure that the university curricula are able to adapt and change quickly in order to be aligned with the needs of industry.

5.3.4 Statutory professional body

Another consideration that was also mentioned by Company J is that of the formation of a statutory body that oversees the software engineering industry. Engineering disciplines are subjected to the rigours of registration with the relevant statutory bodies but this does not apply to software engineering. The benefits of a statutory body would be the following:

- ▶ Students would have to be registered as candidates and acquire the necessary experience before being admitted as engineers, technicians, etc.
- ▶ Collaboration between industry, government and universities becomes implicit.
- ▶ Professional development is fostered through the adoption of continuous professional development programmes as is adopted by the medical and engineering industries. Apart from enhancing graduate employability, employability of the sector in general is improved.

Crucially, the professional body would provide the platform for industry to launch a campaign to become proactively involved in the development of the higher education curriculum for the ICT sector.

Although the Institute of Information Technology Professional attempts to fill this void, it is not a statutory body and hence there is no compulsion for individuals to join.

5.4 LIMITATIONS OF THIS STUDY

Identifying limitations in this study is important as it allows future studies to be conducted to fill the voids of these limitations. A qualitative study is not generalisable but aims to obtain reliable data from experts, the analysis and results of which should be reproducible.

A major factor in conducting this study was the limited time period within which the study had to be completed. This limitation meant that the sample size was constrained and a comparison between the major ICT centres was not possible.

The research targeted the opinions of the experts in industry. There was no input from the universities or student bodies. Furthermore, analysis of university curricula was not conducted to correlate perceived shortcomings identified by industry.

There was no comparison of the findings with other graduate employability findings in different sectors or faculties. There was also no means to compare employability between the various universities to identify whether the institution played a role in the graduate employability of graduates.

5.5 RECOMMENDATIONS FOR FUTURE STUDY

The recommendations for further studies into the employability of ICT graduates are as follows:

- ▶ Expand the research to include all sectors in ICT so that relevant comparisons can be made and general trends or sector-specific problems identified.
- ▶ Research can be conducted from the student perspective so that the challenges experienced by students integrating in a high tech, ever-evolving industry can be established. The university perspective should also be canvassed to provide a complete picture of the supply and demand paradigms of ICT graduate employability.
- ▶ The opportunity to research the topic using a graduate employability model other than that proposed by Finch et al. (2013) which was found to be appropriate for this research study.
- ▶ The effects of compulsory work experience on the graduate employability of ICT graduates. A comparative study of graduates from universities of technology and

mainstream universities would uncover the benefits or lack thereof of compulsory work experience in enhancing graduate employability.

- ▶ Finally, five participant companies indicated that they provide little or no formal technical training for their graduates. A study exploring the effects of adopting a pure mentorship approach to graduate training as opposed to a combination with providing technical skills training should be pursued. This would uncover any benefits or shortcomings of either or both approaches.

5.6 CONCLUSION

The aim and objectives of this study have been met. However, it is evident that a concerted effort is required between government, education and the ICT industry to develop future graduates who are ready to take their place in industry and make a valued contribution to their companies and the economy as a whole.

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APPENDIX 1

Introductory letter

**UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP**

MBA Research Project

Researcher: Navin Maharaj (031) 764 1836

Supervisor: Professor Anesh Maniraj Singh (031) 260 7061

Research Office: Ms M Snyman (031) 260 8350

Dear Participant,

I, Navin Maharaj, am an MBA student at the Graduate School of Business and Leadership, at the University of KwaZulu Natal. You are invited to participate in a research project entitled: **The graduate employability of ICT graduates**. The aim of this study is: To explore the graduate employability of ICT graduates with specific reference to the software development industry.

Through your participation, I hope to understand whether ICT graduates possess the knowledge and skills that are relevant in the software development industry. The results of the interviews are intended to contribute to this body of knowledge on graduate employability.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this interview. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business and Leadership, UKZN. If you have any questions or concerns about participating in the interview, you may contact me or my supervisor at the numbers listed above. The interview should take about 30 minutes to complete. I hope to use this time valuably and not disturb your normal duties.

Sincerely

.....

Investigator's Signature

.....

Date

APPENDIX 2
Consent Letter

UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

MBA Research Project

Researcher: Navin Maharaj (031) 764 1836

Supervisor: Professor Anesh Maniraj Singh (031) 260 7061

Research Office: Ms M Snyman (031) 260 8350

CONSENT

I (full names of participant) representing(company name) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

Furthermore, I hereby grant / do not grant permission for a voice recorder to be used to record the interview.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

.....
Signature of Participant

.....
Date

APPENDIX 3

Interview Schedule

The graduate employability of ICT graduates with specific reference to the software development sector.

- 1. What ICT services does your organisation provide or perform in house?**
- 2. What software development functions do you provide or perform in house?**
- 3. Which of these functions do you envisage graduates to fulfil?**
- 4. What technical knowledge do you expect an ICT graduate to possess?**
- 5. What technical skills do you expect an ICT graduate to possess?**
- 6. Apart from technical proficiency, what other skills do you expect an ICT graduate to possess?**
- 7. How easy is it to recruit skilled ICT graduates?**
- 8. What skills do the ICT graduates bring into the organisation?**
- 9. What are the common gaps in ICT graduate skills and knowledge?**
- 10. What are the reasons for the gaps?**
- 11. What skills training does your organisation provide to ICT graduates?**
- 12. Who provides funding for this additional skills training?**
- 13. What is the average time period a graduate spends on the program before being deemed competent?**
- 14. Would you prefer the graduate curriculum be changed?**
- 15. Has your company been approached by the Department of Higher Education and Training with a view to provide input into the ICT graduate curriculum?**
- 16. Has your company approached the Department of Higher Education and Training with a view to provide input into the ICT graduate curriculum?**
- 17. What changes to the curriculum would you recommend?**

APPENDIX 4



29 April 2015

Mr Navin Maharaj (213571575)
Graduate School of Business & Leadership
Westville Campus

Dear Mr Maharaj,

Protocol reference number: HSS/0340/015M
Project title: The Graduate Employability of ICT Graduates

Full Approval – Expedited Application

With regards to your response received on 24 April 2015 to our letter of 20 April 2015. The documents submitted have been accepted by the Humanities & Social Sciences Research Ethics Committee and **FULL APPROVAL** for the protocol has been granted.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

Please note: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Dr Shenuka Singh (Chair)

/ms

cc Supervisor: Professor Anesh M Singh
cc Academic Leader Research: Mr M Hoque
cc School Administrator: Ms Zarina Bullara / Ms Gina Mshengu

Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

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APPENDIX 5

JEANNE ENSLIN

Freelance language practitioner

17 York Close
PARKLANDS
7441

13 June 2015

Proof of language editing

I, Jeanne Enslin, acknowledge that I did the language editing of **Navin Maharaj's** dissertation submitted in partial fulfilment for the degree of Master of Business Administration.

The title of the dissertation is:

AN INVESTIGATION INTO THE GRADUATE EMPLOYABILITY OF ICT GRADUATES.

If any text changes are made to the electronic document which I sent to Navin Maharaj on 13 June 2015, it needs to be returned to me to check the language of the changes.



Jeanne Enslin
082 696 1224

J H Enslin BA; STD; Hons Translation Studies